SCIENTIFIC AMERICAN

ITALY ON A WAR FOOTING

Vol. CXII. No. 25
June 19, 1915

Munn & Co., Inc., Publishers
New York, N. Y.

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Unless the Goodyear S-V Outwears Any Other

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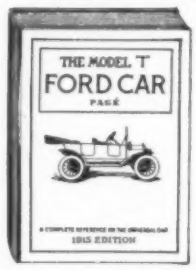

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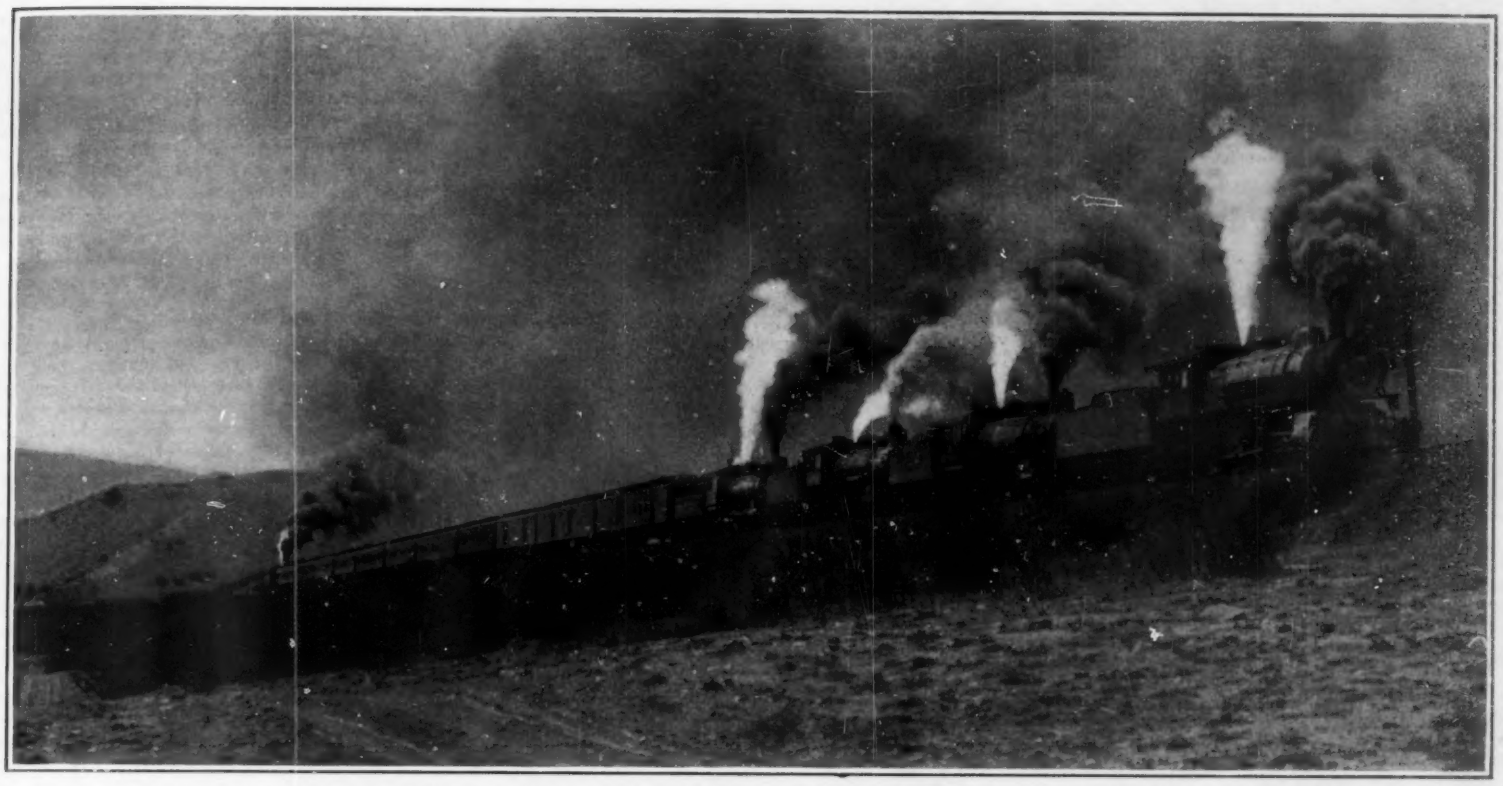
SEVENTY-FIRST YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXII. NUMBER 25.] NEW YORK, JUNE 19, 1915 [10 CENTS A COPY $3.00 A YEAR



Eastbound train crossing the divide at Soldiers' Summit on the Denver and Rio Grande Railroad. Compare this picture with that below.

Running Railroads by Water Power

By Thomas F. Logan

THE accompanying photograph of a Denver & Rio Grande train gives an illuminating view of one of the results of water power conservation. Note that this train has eight passenger coaches, three baggage and express cars and five locomotives. Note the unconsumed fuel discharging from the stacks. Note the waste of fuel represented by the steam discharge from the safety valves.

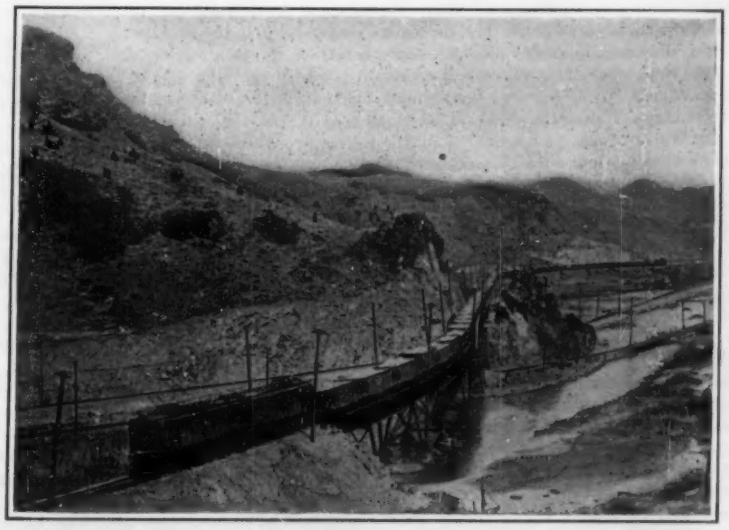
Coal is used less efficiently in a steam locomotive than in any other type of modern prime mover, i. e., in a steam locomotive, it takes more coal to move a ton weight than in any other form of engine.

The combined power of the steam locomotives in the United States is in excess of 50,000,000 horse-power. Of course, all of these locomotives are not in action at the same time. It would probably be liberal to say that 30 per cent are at work at the same time. Assuming this to be correct, we have about 15,000,000 horse-power being developed by railroad locomotives each day in the year.

They consume either coal or oil—for the most part, coal. Our stores of coal are exhaustible. Every pound used makes the available supply so much less and our supply can never be replaced as coal. In the year 1913 we used in the United States 571,048,128 short tons of coal, of which 20 per cent was used by the railroads. This is about 114,200,000 tons of coal.

In contrast with the Denver & Rio Grande picture, note the second photograph. It is a train of seventy-five heavily loaded ore cars on the Butte, Anaconda & Pacific Railroad in Montana. The grade over which that train is going uphill is greater than that on the Denver & Rio Grande road, yet that seventy-five-car train is easily hauled by two electric locomotives, the power to operate which is supplied from hydro-electric plants. Were it not so supplied, that hydro-electric power would be going to waste, as it unfortunately is all over the country. This Butte, Anaconda & Pacific Railroad is, therefore, an agent of conservation. It uses up no coal as does the Denver & Rio Grande Railroad. There are plenty of water power sites along the Denver & Rio Grande Railroad that could be used for operating the trains, but they are all on Government land, and they cannot be developed under present laws.

Every pound of coal used in manufacturing must be supplemented by another pound of coal to transport the manufactured products. This is a striking and true statement and very conservative. Therefore, when we come to consider water power versus coal, the demand for water power is two-fold. According to the thirteenth census of the United States, the power used in manufacturing was 18,675,346 horse-power, the greater part of which was generated by the consumption of exhaustible fuel. If we use the extremely low coal consumption of 7½ tons per horse-power year, we have a coal consumption for manufacturing of 140,000,000 tons, and for the hauling of these products, 114,200,000 tons, giving us a total coal consumption of 254,200,000 tons necessary to the making and distribution of our manufactured products.



Seventy-five heavily loaded cars on the Butte, Anaconda, and Pacific Railroad operated from a hydraulic-electric plant. No smoke, little waste power.

There is much complaint by the railroads concerning increased costs and decreased earnings and the problem is a vital one. The public naturally hesitates to approve a proposal to increase railroad rates. There has been much discussion concerning more economical operation of railroads. By its water power policy, the United States has, in effect, legislated against the economical operation of railroads. See what has happened in the case of the Butte, Anaconda & Pacific Railroad. Previous to electrification, that road paid an average of $22,500 per month for coal alone. That represents the free on board price. The railroad had then to sustain the additional expense of transporting that coal over its own line. Since electrification, this road has paid a little over $8,000 per month for delivered motive power. This means delivered at the locomotive. No extra expense has been incurred for hauling fuel. Therefore, this road has made a saving in operation of $174,000 per year. As the road is only 80 miles long, the saving amounts to $2,170 per mile per annum.

The Chicago, Milwaukee & St. Paul Railroad is now electrifying 450 miles of its road between Harlowtown, Montana, and Avery, Idaho. Its contract for power involves an annual payment of $550,000. Remember, this is delivered power. The present cost of coal over these 450 miles of line is $1,750,000 per year, and the railroad owns the mines. Nearly 35 per cent of the railroad equipment is used in carrying that coal to its coaling stations. But this expense is not included in the above $1,750,000. Considering only that figure, we have a prospective saving of $1,250,000 per annum, equivalent to $2,666 per mile per annum. All of this electric power, by the way, is generated at water power sites which are located on private lands. It has not been possible to prevent the development of these power sites under destructive laws and conservation policies. The story is different, how-

(Concluded on page 616.)

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp* the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Recent Change in the Cabinet

THE recent resignation of the Secretary of State has brought to a head a movement which it is now evident had been in course of development for many months. Although the break between the President and the Secretary of State was the direct issue of a conflict of policy with reference to the "Lusitania" outrage, it is evident that the breach had been widening owing to differences of opinion with reference to the policy of State. These differences are fundamental and irreconcilable. The people of this country believe in peace and look upon war with the same horror as the Secretary of State; but they do not believe in proclaiming that there is peace when there is no peace. It may safely be stated that the infraction of the rights of American citizens and the taking of their lives wantonly and without excuse will not be tolerated.

The late Secretary of State is a gentleman of much sweetness of temper and gentleness of nature, but events have shown that he was entirely unqualified for the serious responsibilities of his important position. This was chiefly due, it seems to us, to an utter lack of appreciation of the greatness of this country and of its vast humanitarian and commercial responsibilities. It has been well known that during the two years of his office American merchants owning property in Mexico or South America, or having commercial relations with those countries, have received but scant consideration in the Department of State. After interviews with the Secretary of State they have frequently come away from the Department with the feeling that, in addition to the lack of Government protection, they were suffering personal disfavor because of the mere fact of their having established business enterprises in foreign countries. It is a notorious fact, and one which has brought the blush to the face of many Americans, that although during the strife which has occurred in our neighboring republic, American citizens have lost their lives and been subjected to outrage, the Department of State apparently did not regard these acts with the horror that their seriousness demanded. This country's future demands a different policy from the rural dispensation of the past two years. It has vast foreign interests, and its commercial relations abroad are of an intricate and extensive character. These interests must not be jeopardized by any weakness of policy of the State Department. The United States must discourage the belief that American lives can be sacrificed with impunity.

That this policy of "no protection" has been brought to an end is very evident from the recent message which has been sent to the Mexican chieftains and from the message to Germany protesting against the infraction of American rights.

The European war now has been in progress for nearly a year, and at the very outset, the people of our land were rudely awakened to the fact that certain forces were in action which were strange and new to them; that human nature had not reached the ideal state which the American people had supposed; that in spite of living remote from European strife and in supposed safety from European entanglements, we were likely to be dragged into complications which we could not foresee. Efforts were made, therefore, to induce Congress to take some action—not to establish a large standing army or a great navy, but to strengthen both arms of the service so that the country could be placed in a condition at least of adequate defense. Such influences as were brought to bear, however, came to naught, and Congress adjourned without making any provision to improve the condition of the Army and its reserves. Indeed, it did so little to remedy the avowed and well-known deficiencies in the Navy, that an almost unprecedented condition of affairs has followed, in which private citizens have formed themselves into associations and bodies of men, independent of the Government, to try to remedy the failure of the Government to provide for its military deficiencies. A number of influential associations have been formed whose policy is not only to educate the people in the facts regarding our military weakness (so well known abroad and in professional circles here), but also to organize young men voluntarily into groups and bodies of men, for military training. All this has been done without support or even recognition from the Government.

It was surmised before the war broke out, and has been proved during the ten months of conflict, that naval warfare has been greatly modified by the advent of the submarine. It became known that our own submarines were defective, that they were not sufficient in number, and that only a few were in a condition for actual service. Through some defect in one of these craft a number of our brave sailors lost their lives during simple peace duty. What sufficient action has our Navy Department taken to remedy this well-recognized deficiency in this arm of the service? The recent Congress ordered the construction of several new submarines, but made no provision for the officers to man them. No provision has been made for building any battle-cruisers—an invaluable type of ship—as the war has proved.

The one thing that the SCIENTIFIC AMERICAN would deplore above everything else would be that we should become entangled in the European or any other war. This would be against the spirit of our people and certainly against their interests. The lesson we have tried to teach through the columns of the SCIENTIFIC AMERICAN has been that of preparedness for defense and the protection of its citizens against injury and insult.

Ammunition and Finance in the Present War

A FEW months after the opening of the European war a leading general of the German army stated that the expenditure of ammunition had proved to be more than double the amount which the staff had estimated. And that statement was made before it had been demonstrated, as it has been lately on the western battle front, that the only possible way to break the apparent stalemate produced by trench warfare was to plow up the enemy's trenches by a concentration of high-explosive shell fire, the like of which had never been seen, and was certainly never contemplated in modern warfare. Nevertheless, in spite of an expenditure of ammunition which to-day must be between two and three times as great as was estimated before the war by the Germans themselves, and in spite of the enormous battle front on which the Teutonic Allies are engaged, there are no indications that they are suffering from a scarcity of ammunition. This is to be explained by the fact that, for many years, the central powers have been laying up a huge reserve of ammunition for a conflict, the date and the extent of which had probably been determined and certainly had been lavishly provided for. Add to this the probability that, from the very commencement of the war, all the manufacturing plants which were capable of turning out ammunition were reorganized, re-equipped and set to work at their maximum capacity, and the manifest superiority of the Teutonic Allies in the matter of ammunition supply is readily understood.

It becomes increasingly evident, as the war goes on, that the question of victory or defeat for either side will be determined on the German western battle front; and here, if, as the Allies hope and believe, they are to drive the German line back upon the Rhine, the thing can be done only by blasting them out of their trenches, line beyond line, by a concentration of explosive shell and shrapnel fire so great, that even the German resources will be outmatched, not in one particular engagement or series of engagements, but day by day, week by week, and month by month, until the thing is done.

The tactics employed in this kind of warfare are fairly familiar to the general public from the published press reports. The batteries of the attack are masked along the given stretch of front to be attacked and the enemy trenches are subjected to a continuous rain of high-explosive percussion shells, which literally plow the trenches out of existence, breaking down the parapets, filling up the trenches with *débris*, and exposing the troops to a decimating fire. When the wreckage is complete, the high-explosive shell fire gives way to a rain of shrapnel, delivered back of the wrecked trenches in such volume that it is impossible for reserves to advance through the hail of bullets in sufficient strength to deliver a strong counter attack. Under the protection of this shrapnel fire, the attacking forces move forward and capture the plowed-up trenches, digging themselves in and consolidating the newly-won position. This form of warfare necessitates, above all, an enormous supply of ammunition, and an output from the factories that shall be on such a scale as to enable the generals in the field to carry on the offensive without any anxiety as to their ammunition supply.

Now, ammunition, especially of the high explosive and shrapnel shell type, is enormously expensive, and the drain upon the financial resources of the belligerents, if such a continuous attack is made and met, will be far in excess of anything that has occurred hitherto during the war. The question of ammunition supply becomes intimately associated with the question of financial resources.

In the unhappy event of our becoming embroiled with Germany, the United States, because of the enormous extent of its manufacturing resources and its vast wealth, would become the pivotal point around which the ultimate destinies of the war would turn. Without touching a soldier or a ship, or firing a gun, the enrollment of the United States on the side of the Allies would make their ultimate triumph absolutely secure.

Up-to-Date Disinfection

THE newer disinfection—the destruction of disease germs in the homes of sufferers—has come about through knowledge gained the last half century as to how such infections as yellow fever, typhoid, malaria, measles, tuberculosis and the like are transmitted to mankind. As everybody now knows, yellow fever is transmitted only by *Stegomyia*, malaria only by *anopheles;* the body louse transmits typhus; such diseases are not "caught" by fomites (goods and fabrics that may happen to contain the germs), as was formerly supposed. Cholera and typhoid fever are not contracted through miasms; but solely by swallowing the essential germs of those diseases in food and drink thus contaminated. Diphtheria is probably not communicable through the air; but by direct contact with the sick, as in kissing; or by contact of one's nasal passages or throat with the diphtheria germs as contained in the handkerchiefs, dishes and the like used by patients. The safest place in the world as to diphtheria is the properly conducted, well-aired ward of a diphtheria hospital. Hospital doctors, nurses, and others, careful in their ablutions, are in constant attendance the year round on diphtheria, scarlet fever and measle patients, without contracting those diseases or being in any fear of them. The surest place not to contract consumption is a well-managed tuberculosis sanatorium.

Nor are scarlet fever and measles transmitted through the "peeling" or the skin eruptions in those disease. And measles is infectious anyway only during the first several days of the disease, generally before it is recognized, and from the germ-laden discharges from the noses and throats of sufferers.

Facts of this kind have led to more rational public health measures. Certainly disinfection destroys germs or renders them innocuous; but most germs cannot in any event retain their vitality and their capacity for mischief for any length of time after leaving the patient's body. And, as a matter of fact, the best disinfectants ever invented are pure air and sunshine. A sick room well ventilated after the termination of a case; the bedding, carpets, rugs, and so on exposed to the blessed sunshine; plenty of soap and water for scrubbing up. These factors will, for most infectious diseases, be all the disinfection necessary.

Thus, in accordance with the modern conception of infection spread, the Metropolitan Board of Health, in 1913 abandoned fumigation (disinfection by gases generated from sulphur, formaldehyde and the like) after diphtheria cases; but removed the bedding to its disinfection plant. Fumigation of the apartment was done only when the patient died or was removed to a hospital during the height of the disease, it being considered possible that in such cases fresh discharges containing living germs might be present in the sick room. Measles was similarly handled, except that the household goods were not removed for disinfection after death or recovery. In scarlet fever disinfection was done after recovery, death or removal; and the infected bedding was disinfected. In June, 1914, however, the department discontinued disinfection, by reason of the practical absence of danger from patient's effects, after cases of diphtheria, scarlet fever, measles, cerebrospinal meningitis and poliomyelitis. And with the beginning of the present year it was determined to discontinue fumigation altogether in all the boroughs of the Greater New York, except Brooklyn; and this in order for comparisons to be made and for a demonstration that discontinuance of the practice of fumigation will work no harm of any kind.

Science

The Crocker Land Expedition.—The work of this Arctic expedition is to terminate with the present season. The schooner "George B. Cluett," a vessel used by the Grenfell Association in provisioning the mission stations along the Labrador coast, has been chartered to bring the explorers home, and will leave Battle Harbor for that purpose early in July. It is supposed that the expedition, which found Crocker Land to be non-existent, has been recently engaged in exploring and mapping the interior of Greenland.

The Importation of Foreign Birds.—According to a recent paper by Dr. T. S. Palmer, the Department of Agriculture issues about 500 permits annually for the importation of birds; the number of birds imported amounts to about half a million, and as many as 17,000 birds arrive in a single day. These include especially canaries, parrots, and game birds, but the total number of species imported is about 1,500. The department exercises great vigilance to prevent the importation of bird diseases, such as the "quail disease."

Thunder at Sea.—Baron von Humboldt was responsible for the statement that thunder is never heard on the high seas—i. e., at any great distance from land—though violent thunderstorms are often observed at sea and vessels are frequently struck by lightning. Is the statement true? Or, if thunder is sometimes heard, is its sound comparatively faint? These questions have provoked discussions from time to time at meetings of the Astronomical Society of France, and have recently been taken up anew by that society. It is suggested that the other noises prevailing on shipboard during a storm may be the reason why the thunder often passes unnoticed, but information on this subject from sailors will be welcomed by the French astronomers.

Cures for Ivy Poisoning.—*The American Botanist* publishes a letter from a Brookline, Mass., correspondent stating that fishermen along parts of the Massachusetts coast find a prompt cure for the effects of poison ivy and poison sumach in the fireweed (Erechtites hieracifolia). The poisoned parts are rubbed with the leaves of this plant, which must be fresh each time, bruised and crushed so that the sap moistens the skin freely. An editorial note mentions the fact that a large number of other plants have been recommended for ivy poisoning—notably touch-me-not and burdock—but that "it seems doubtful whether any of these herbs can do more than take the attention of the patient from his troubles and cure him by mental suggestion."

The Loss of the "Endeavour."—A note in the *Geographical Journal* records the probable loss of the fishery investigation vessel "Endeavour," belonging to the government of Australia, together with Mr. H. C. Dannivig, director of fisheries to the commonwealth government, his staff, and presumably some meteorologists and wireless operators from Macquarie Island. The vessel had proceeded to this island in order to relieve the staff of the meteorological station, which was established by Mawson's Antarctic expedition and subsequently taken over by the Australian government. She left Macquarie December 3d on her return voyage, and has not since been heard of, in spite of a thorough search for her by government steamers. The "Endeavour" was built in 1908 for fishery research in the open ocean on the lines of the Michael Sars, and had done considerable valuable work of this character.

The Singular of "Sastrugi."—No one can read any considerable amount of current literature relating to polar exploration without metaphorically stubbing his toe over one of those rugged ridges of snow which are known collectively as "sastrugi." This exotic term has become fully naturalized in the English scientific vocabulary, yet strange to say it is rarely met with except in the plural, and when an author undertakes to singularize it the result is apt to be singular in more senses than one. Thus Capt. Scott in his diaries mentions a "sastrugus," and this ostensibly Latin word is defined in the glossary appended to "Scott's Last Expedition." The dictionaries are much at sea on the subject. The new Standard, for instance, gives two forms of the singular, "sastruga" and "zastruga," and does not mention the plural at all, though, as we have stated, the plural "sastrugi" is the form commonly met with in English. The history of this word is traced by C. F. Talman in a recent number of the *Monthly Weather Review*. The word is Russian, and the original form is "zastruga," which means literally a rough splinter or shaving due to planing wood against the grain, but has also a number of derived meanings. The more or less permanent snow-ridges characteristic of the northern Siberian plains, where they show the direction of the prevailing winds and hence indicate to travelers the points of the compass, are called "zastrugi," and this word, altered to "sastrugi" in accordance with German rules of transliterating Russian, was made familiar to the world at large through the writings of Baron von Wrangel. It occurs in English as early as 1840. Given this form of the plural, consistency requires us to make the singular "sastruga," though the Russian is "zastruga."

Aeronautics

The Navy Gets More Hydroplanes.—Two new hydroplanes were recently delivered to the Navy Department, three others are now under construction, and three further machines are to be contracted for this summer.

Lazy Tongs Rim for Parachute.—In a patent No. 1,138,140 Anton Oister of Unter Siska near Lailbach Austria-Hungary, shows a parachute whose rim is formed by a lazy tongs with springs at the joints of the tongs for automatically expanding the same and the rim of the parachute when the latter is released from a container adapted to hold it when in a collapsed condition.

Noted Aviator Killed.—A report has been received that Albert Moreau, the noted French aviator had been killed by his machine falling near Melum. Moreau has been very prominent in aeronautical matters for some years, and was the inventor of a safety device, with which he won a prize in 1913 by flying his self-righting aeroplane without touching the control levers.

Aeroplanes to Locate Seals.—The past sealing season in the Gulf of St. Lawrence, which closed May 1, was a failure owing to the difficulty of finding and reaching the herds in the unusually heavy ice, and entailed a loss of about $250,000 upon the owners of vessels. Next year it is proposed to engage two aviators to visit the east coast and the Gulf of St. Lawrence, respectively, just before the opening of the season and locate the herds. If successful, this plan will save the large amount of time now lost by sealers in searching for their prey, and should add correspondingly to the profits.

A Dirigible for the Navy.—It is announced that the Navy Department has ordered a dirigible aircraft from a Connecticut company, which is to be delivered within four months, and will cost $45,636. This craft will be 175 feet long, 55 feet in height and will accommodate eight men. The speed will be 25 miles an hour. This craft cannot be seriously regarded as a fighting machine, but is probably intended merely for practice purposes and for training operators for possible future craft. The battle cruiser North Carolina, which has become superannuated, is to be remodeled to serve as an aviation ship, and will be sent to Pensacola, which is to be made a station and school for training aviators. As soon as it is finished the new airship will be sent to the same place and a floating hangar is to be provided to shelter it.

A New German Biplane.—Just before the hostilities the Otto Company, of Munich, which had been building machines of the engine-behind type, brought out a new tractor, which is believed to be now in use by the army. It generally follows standard lines, with a rectangular body, topped with a turtle back. The upper plane has a slight overhang, and both planes have a decided taper toward the tips, the leading edges sloping backward. The lower planes are attached to the body, and the upper to a center section carried on a steel tube structure. Two pairs of steel struts connect the upper and lower wings on each side. The tail planes consist of a semicircular stabilizing plane, to which is hinged the divided elevator, and of a partly balanced rudder, hinged to the stern-post of the body. The engine is a 150 horse-power Rapp.

Big Foreign Orders.—Many rumors of big orders from foreign governments for aeroplanes and motors are circulating through the daily press, the value of the material contracted for being estimated at $16,000,000. The latest report is that two orders, each for 1,000 aeroplane engines, are going a-begging because every manufacturer already has more orders for complete machines than he can handle. Speaking of these orders it is said that machines of the pusher type are preferred abroad, but our builders are not prepared to turn out this kind, having had no experience with them; however, it was a question of taking what they could get, so the foreign orders were placed for the tractor models that prevail in this country. There is apparently difficulty in procuring engines of sufficiently great power, as the foreign buyers demand motors of from 130 to 160 horse-power, and these are not being produced in any considerable numbers as yet.

A Fund for Aero Defense.—In view of the extremely backward condition of aeronautics in the United States, both in number of machines and qualified operators, the Aero Club of America proposes a national subscription, similar to those organized in France and Germany in 1912-1913 with a view to training aviators, procuring aeroplanes for the National Guard, Naval Militia and the Post Office Department, and to do whatever else appears necessary and possible to create an efficient aeronautical reserve, which at this time would seem most urgent. It is pointed out that not only have we practically no aeroplanes, but that out of the 150 licensed aviators in the United States, probably not over half a dozen have made flights of over 50 miles across country, and none have any knowledge of military requirements. The National Competition, commencing in July, which has already been noted, is hoped to stimulate interest and assist this movement. Contributions to the fund can be sent to the Aero Club of America, 297 Madison Avenue, New York.

Inventions

Another Dedicated Patent.—Robert M. Chapin of Washington, D. C., has dedicated to the public patent No. 1,137,844 for a process of preparing a concentrated animal dip from arsenious oxide especially designed for dipping or spraying of cattle or other animals with a view to ridding them of Texas fever ticks or other deleterious parasitic insects.

A Two-faced Doll.—Practically two dolls in one is supplied by patent No. 1,138,412 to Mary E. Radick of White Plains, New York, who makes the doll head with two diametrically opposite faces, the expressions of the faces being different and the hair being so connected with the head that it can be moved to cover either face and expose the other.

Foldable Sewing Machine.—Sarah E. Avery of Columbia, S. C., has secured patent No. 1,136,921, which discloses a cabinet with a compartment into which the needle operating mechanism may be folded, also a folding table to support such mechanism for use and a drive mechanism which in use may underlie the table and when not in use will be housed between the folding table and the cabinet.

Locking the Milk Bottle to the Door.—Louis Levitt and Isidor Rendelman of New York city, provide in a patent No. 1,139,780 means for closing and clasping a milk bottle neck and a chain connected with the clasp and engaging under a door so that when the bottle is once secured it cannot be released until the door is opened. Something like this is needed when the milkman is ordered to leave milk at the door.

The Only Universal Standardization.—C. Francis Jenkins whose inventive activities in moving picture matters as well as in many other important fields of invention are well known, in a recent address in Washington city stated that the motion picture ribbon is the only unit that is standard in every country and that while railway gages for example vary in different countries, and units of value, volume, length and weight differ, the motion picture film is the same the world over.

A **Gaisman Safety Razor Improvement.**—Henry J. Gaisman of New York city, who sprung into prominence some months ago as the inventor of the autographic kodak, bought by the Eastman Company for a large price, in a patent, No. 1,139,115, presents a safety razor in which the flat blade which can be flexed in curved condition is used with a guard for its edge separate from the holder, with the blade and guard relatively adjustable, with means for holding the guard in graduated positions for purposes of shaving.

Moth Proof Bags.—In the spring season the packing of woolen garments demands attention. Moth proof bags are a convenience and the expense of the bags if used once and discarded suggests the possibility of devising a bag whose open end can be securely sealed by pasting in such a manner that when once cut open provision will be made for its repasting succeeding seasons. Incidentally the bag should embody means for suspending the garment within it, and for hanging the bag and contents from a supporting hook.

Speaking Moving Picture Improvement.—In patent No. 1,137,060 Orlando E. Kellum of Los Angeles, Calif., connects the moving picture camera and the sound recorder by wires so they operate synchronously and places the telephone transmitter on the person of the actor, electric connections being provided between the transmitter and recorder and suitable contacts being provided, including stationary contacts and contacts on the person of the actor and adapted to engage the stationary ones when the actor is in the field of view of the camera.

Edison Colored Moving Pictures.—Thomas A. Edison in a patent No. 1,138,360 presents a method of producing the illusion of scenes in colors in moving pictures. An image of all the elements of a scene of one fundamental color in that color is momentarily projected on the screen and thereafter successively projecting images which are superposed upon or registered with the first image on the retina of the beholder of those elements of the scene of different fundamental colors in their proper colors respectively. The successive projections are at such a rate that in accordance with persistence of vision, the preceding images will still be seen by the beholder until after the last image of the series has been projected upon the screen.

Developing Effect of a Patent System.—An American born son of an intelligent foreigner recently commented on the decadence of his father's native land and attributed its failure to progress and take a prominent part in the world's affairs to its lack of a patent system. He asserted, and correctly, that, no nation in recent time has made any substantial progress that did not foster invention by a reasonable patent system which would encourage invention and so develop the country's resources along lines of mechanical progress. If invention develops a nation, it likewise develops the individual, benefiting him not only indirectly by the pecuniary results but directly in the personal broadening resulting from his inventive effort.

Loading mine cases to destroy a derelict.

Placing mine to blow up masts of wrecked steamer "Monroe."

Blowing up a derelict with gun-cotton mines.

Hunting for Derelict Ships

The Difficult Work of Clearing the Seas

OF the numerous duties allotted to the United States Coast Guard cutters, one of the most interesting is that connected with the search for the derelict vessels left in the path of commerce by the periodic gales which sweep over the western ocean, and the salvage or destruction of these dangerous wanderers of the sea. The great majority of abandoned and drifting hulks come from the fleet of lumber-laden sailing ships plying our coastal waters or voyaging from southern ports to continental Europe. These craft, stripped of spars and sails by storms, or waterlogged and unmanageable from leaking sides, float with decks awash, often bottom up, prevented from sinking by their cargoes, and usually surrounded by attached floating wreckage which renders their approach in small boats difficult, and the placing of a working party on board extremely hazardous except under the most favorable conditions of wind and sea.

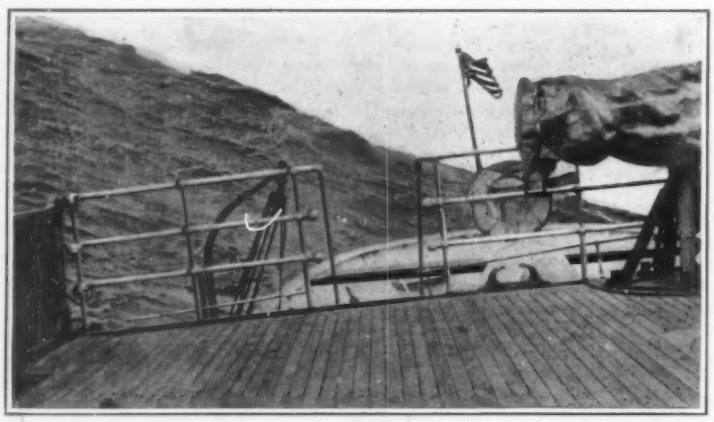
Dots upon the ocean, their dimensions shrink to invisibility upon the ocean charts by which the searching cutter tracks them; drifted from their reported positions by unrecorded winds and currents, low in the water and hidden by the passing waves, they enter the class of elusive objects not far behind the submarine boat of modern warfare. However, there is a well-organized campaign conducted against them, shared by all mariners and actively furthered by our Government. Here, as in so many other fields of maritime operation, radiotelegraphy plays an important part, and without it the chances of success in finding an object at sea are reduced to a minimum. Each of the hundreds of merchant steamers crossing and recrossing the ocean is a self-constituted observer and lookout for the discovery of these menaces to safety, and their positions when sighted are quickly and accurately flashed to the coastal stations, thus eliminating from the problem half of that destructive element, time, which formerly claimed its full allowance in delaying the start on the search, and by so much making it difficult or fruitless.

There are several approved methods of laying out the courses of the searching vessel once the vicinity of the reported position of the abandoned craft is reached. Allowance for its probable drift is computed for the time elapsed since the report of its position was sent out, and upon the correct results of this computation success or failure of the search largely depends. Human ingenuity must ever be on the alert in its predictions regarding those ever-changeable elements, the winds and ocean currents, and their varying effects upon each other from day to day. The drift of a waterlogged vessel off our Atlantic coast may reach as high as seventy or eighty miles in a day of twenty-four hours, and it is within the range from this figure down to zero that the computations must be made. When it is considered that with the most prompt action a delay of two or three days may ensue before the vessel sent out on the search can reach the reputed locality and that she then must take up a system of devious courses while her quarry drifts merrily on in a more or less direct course, some idea of the nature of the task can be formed.

When the reported position is reached the cutter may be set to describing upon the ocean waste one of several accepted geometrical figures. These comprise some form of spiral, or related parallelograms or triangles. Adjacent lines are maintained a distance apart not exceeding twice the estimated distance of visibility of the object sought, and this naturally varies from time to time with the condition of the atmosphere. The men in charge must decide, under penalty of increasing the steaming distance unnecessarily if their assumption is too small, or of missing the object finally if too great. For if it once be passed, the rule of search is such that there is little likelihood of the steamer's returning to the vicinity.

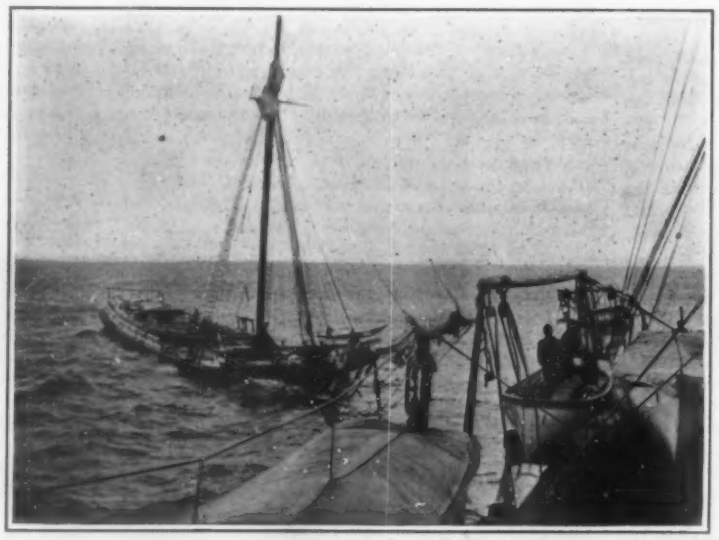
The search must necessarily be suspended at nightfall, but the steamer is kept as nearly as may be in the same position during the night, or if forced to steam ahead by heavy sea conditions, she is returned at daylight to the point where the search left off. Current set at this stage of the operations is not so important, inasmuch as it is likely that the steamer and the vessel sought for are under similar influences of drift. Granting that all the conditions have been correctly predicted and allowances rightly made, there comes the welcome moment when some sharp-eyed observer on deck or at the masthead announces the sighting of the wanderer. A distinct change in the mental atmosphere on board the steamer is at once apparent, as the methodical operations of a perhaps long and weary search give way to the active preparations for dealing with the stranger. If there is any possibility of towing the outlaw into port, the first effort will be made in that direction. This plan has the added value of saving property, which is, of course, the first thought of an organization created for the purpose. But the average derelict does not lend itself readily to the restraint of a towline, nor does it follow with good will in the wake of the towing steamer, but drags along now on one quarter, now on the other, occasionally coming up as far as abeam in a startling exhibition of perversity. For this reason, if the distance to land be great, the decision may be made to destroy the unwelcome intruder, and this is now generally done by the use of a standard guncotton wrecking mine.

Destroying a waterlogged hulk is, however, not always an easy operation. If the cargo is general merchandise or coal a single charge of explosive would quickly send it to the bottom; but when the hull is tightly packed with lumber, which is itself buoyant, no ordinary hole in the vessel's hull will have any effect, and it may be necessary to blow the hull into pieces, using many heavy mines, in order to disintegrate and disperse this troublesome cargo. Then again, a craft may have gone down in some comparatively shallow passage with her masts standing, and possibly not showing above the surface. In this case it often requires considerable labor and ingenuity to blow out these obstructions and make navigation safe. In one of the illustrations a diver will be seen engaged in work of this kind.



Revenue cutter "Miami" running before a gale on April 14th, 1914.

Note high sea on starboard quarter.



Derelict schooner "Warren Adams" of Philadelphia.

Cargo Southern Pine. Found by cutter "Itasca" and towed into Newport News.

Cheap Substitute for Horn

A CHEAP substitute for horn can be made from wheat flour and sodium silicate. This substitute is very hard and strong, and, by inserting organic dyes into the composition while mixing, it can be colored to imitate almost any kind of horn substance.

The compound is made by mixing ten parts by volume of sodium silicate (40 deg. Baumé) with distilled water, and then stirring the resultant liquid into a thick paste with fine white wheat flour. The mass is then allowed to stand for three weeks, during which time it undergoes a chemical reaction that produces a hard hornlike substance.

This composition can be molded without pressure when first made, and turned and machined like brass after it has set.

Photographing Speech

Some Recent Investigations by Dr. Marage

By Jacques Boyer

DR. MARAGE is going to make the old adage "Words fly" untrue. Thanks to his fortunate discovery, words will not fly away of themselves any more; he has just succeeded in photographing the vibrations that compose them.

For overcoming the difficulty he directed his attention to the Pollak-Virag telegraphic apparatus, which he modified very skillfully, and to understand its functions we must first study the present work of Dr. Marage.

The Pollak-Virag telegraph (Fig. 1) is the most rapid of the known systems, for it can transmit 40,000 to 50,000 words per hour, while the Baudot sends 4,000 and the Morse only 400 in the same time. Before sending the signs which compose the dispatch a preliminary manipulation is necessary. By means of a special machine for writing (Fig. 3) holes are made in a narrow strip of paper, the different perforations of which correspond to the different letters of the alphabet. On the transmitting key the perforated paper unrolls and, according to the dimension and position of the perforations, a mechanism allows the passage of currents more or less prolonged at longer or shorter intervals. At the other end of the line there is a registering apparatus (Fig. 2), consisting of a mirror upon which a ray of light falls. Under the influence of the current sent by the transmitter the mirror is displaced by a horizontal-vertical movement and the beam of light makes an impression of various sorts on a sensitized paper which unrolls.

In order to avoid the secondary photographic operation the paper which has received the impression passes in unrolling into a first developing bath, then into a fixing solution. It is only necessary to read the message, as easy to decipher as a printed page, as the *facsimile* given shows.

Now that we know the principle of the Pollak-Virag telegraph, let us study some details of each of its parts.

The perforating machine, completely independent of the telegraphic system, makes in the strip of paper, which is moved by a guiding device operated by an electromagnet, holes of unequal size, whose series correspond to the text of the telegram. A letter in ordinary hand-writing includes really vertical and horizontal lines. Let us analyze, for example, the most simple letter of the alphabet, *l*. It is composed of a long vertical line, of a short vertical line which makes the curve, of a horizontal line joining them at the top, and a horizontal line at the bottom. In perforating the letter *l* will be represented by a large and a small hole, which will throw a strong current, then a weak one, into a telephone tracing vertical lines, and then by two small holes which will send two weak currents into the telephone inscribing the horizontal lines. In view of the succession and overlapping of the current one upon the other, the angles are rounded off.

To each letter of the alphabet correspond definitely 2, 3, 4—up to 10 different sized holes. Once the band is perforated the telegrapher inserts it into the transmitting apparatus. There an ordinary electric installation puts in motion the guiding device, while by means of the connecting plug (*la poignée d'un interrupteur*) the telegrapher puts the receiving station into the cir-

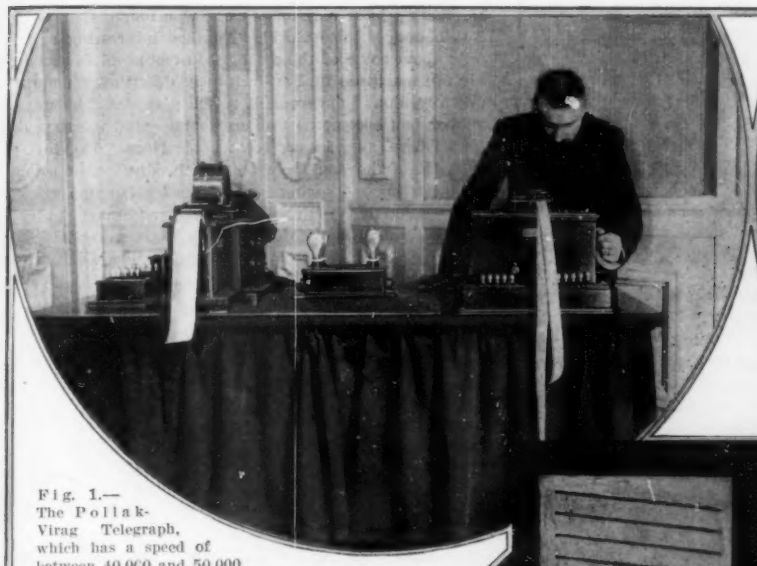


Fig. 1.—The Pollak-Virag Telegraph, which has a speed of between 40,000 and 50,000 words an hour, while the Baudot sends 4,000 and the Morse only 400 in the same time.

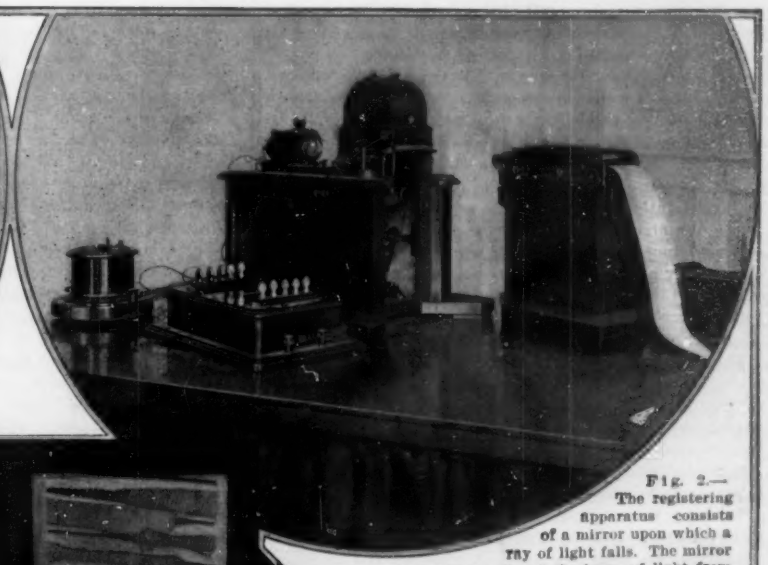


Fig. 2.—The registering apparatus consists of a mirror upon which a ray of light falls. The mirror is electrically displaced and the beam of light from the mirror writes on a piece of sensitized paper.

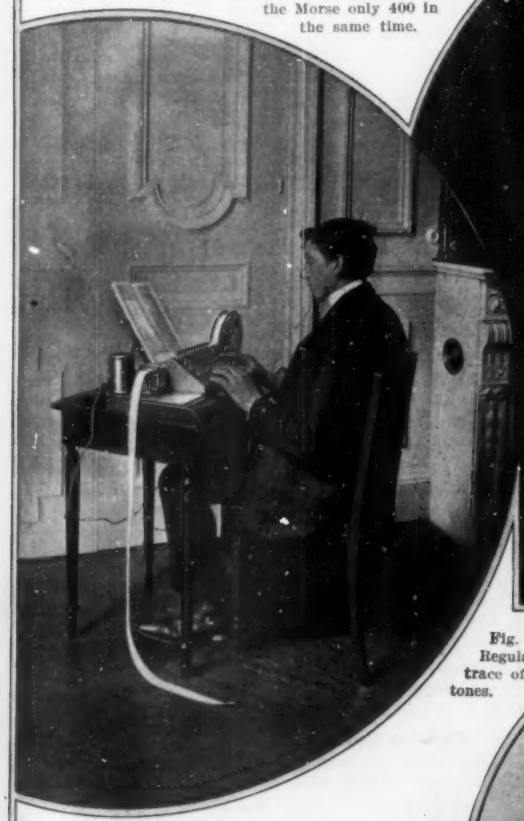


Fig. 3.—The perforating machine of the Pollak-Virag Telegraph.

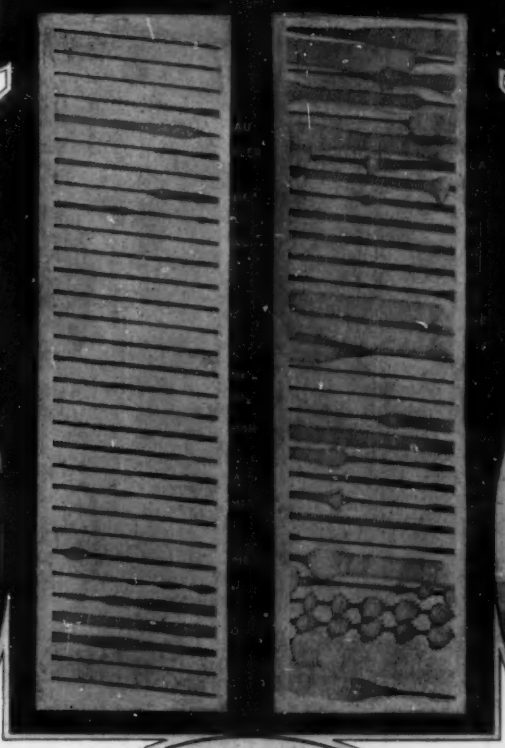


Fig. 4.—Regular trace of tones.

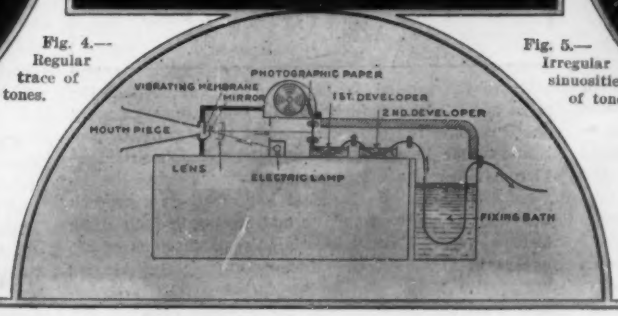


Fig. 5.—Irregular sinuosities of tones.

Fig. 6.—Making a record of the human voice.

Photographing speech.

cuit. In the last place the writing of the message works in the following way: Light from a point of the filament of an incandescent lamp passes through an aperture in a screen and falls upon a strip of photographic paper, reflected by a little mirror whose back face of iron rests upon three magnetic points.

The diaphragms of two receiving telephones being put in motion by the electric currents of the transmitting telegraph, communicate to the mirror by means of two little stems (tiges), slight displacements at right angles to each other.

As a result of the rotation of the drum and the repeated movements of the luminous points from left to right on the sensitive paper, as well as of the advance of the latter, inclined lines are written on the photographic band as long as the mirror remains still. But when this mirror moves under the action of the vibrating diaphragms the luminous ray writes letters following these inclined lines. A window furnished with a red glass permits one to follow the displacements of the incandescent point, which appears as a sort of writing flame.

When the dispatch is entirely transmitted a knife cuts the strip, which has now only to pass through the photographic baths.

Mr. Pollak has overcome many difficulties to make this last part of his telegraph easily usable. In the first place, the duration of the exposure is very short. In other words, the time during which the luminous point is moving upon a surface equivalent to its own size does not exceed 3/1,000 of a second. In the second place, the photographic processes must go very rapidly, for the accumulation of sensitive paper in the developing and fixing baths would be a difficulty which would rob the system of most of its advantages. The inventor has succeeded in this delicate undertaking. He has invented a device which effects the development in five to six seconds, the fixing in six to seven seconds, and furnishes the messages ready to be delivered to their destinations. In truth, the surface of the gelatine comes out slightly damp, but with blotting paper it can be dried immediately, so that telegrams do not need any further manipulation before being given to the messengers. Besides this, the machine develops and fixes bands of small size as well as strips 25 meters long and .07 meter wide, containing about 10,000 words.

Thus, the Pollak-Virag telegraph shows great advance over its predecessors. Unfortunately, there is some shadow over the picture. Indeed, iron wires or ordinary cables could not be employed when great distances are involved. Such wires do not permit the passage of interrupted currents at the required frequency of 300 to 400 interruptions per second. The wires ought to be of bronze. However, in spite of this transformation of material, the Pollak-Virag devices retain their economic advantage, for with two wires they permit the sending of as many words as a Hughes telegraph employing twenty wires; their substitution for the other systems will have to come in the future, without taking into consideration that with them half as many employees are sufficient to transmit the same amount as with the Hughes system.

Finally, these ingenious mechanisms devised by Mr. Pollak and his friend Virag have permitted Dr. Marage *to photograph speech*. The diagram and the photograph (Fig. 6) make it possible for us to understand the arrangements which he employs. The novelty introduced by the eminent French investigator consists in the suppression of the manipulator. He replaces it by a microphone put in communication with one of the two receiving telephones, the one which gives vertical oscillations. The telephone then transmits the vibrations of the words to the movable mirror and the luminous ray photographs itself on the paper. Each line of the inscription obtained corresponds to a quarter of a second.

Thus, one has all the elements necessary for appreciating the qualities of a voice. In fact, to know the duration of each tone it is sufficient to count the number of lines inscribed by the vibrations. If there are three lines, the tone lasted three fourths of a second, if there are four lines the tone has been emitted four fourths of a second; that is to say, one second for each line lasts one quarter of a second.

On the other hand, the regularity or irregularity of the vibrations attests the homogeneity or non-homogeneity of the sound.

At last, to appreciate the precision the number of vibrations corresponding to each of those is calculated. For that the number of vibrations traced upon a line is counted and multiplied by four, which gives the number of vibrations per second. As for the time elapsing between two consecutive tones the measure of the straight line separating each of them, and showing that there was no vibration in the interval, gives it immediately.

If a singer sings a scale without interruption between the tones, and if he possesses a voice of good quality, a regular trace will be obtained (Fig. 4), while if the vocal cords are badly used or tired, irregular sinuosities will appear upon the paper (Fig. 5).

We have submitted Mr. Boyer's account of Dr. Marage's experiments to Dr. Floyd S. Muckey, a well-known throat specialist and authority on the human voice. Dr. Muckey comments as follows: Oral speech is composed of vowel and consonant sounds. Vowel sounds are musical tones, that is, the vibrations or air waves follow one another at regular intervals. On the other hand, the consonant sounds are largely noise, the vibrations occurring at irregular intervals. It is thus clear that there must be a marked difference in the composition of these two classes of sound. It is also a well-known fact that the various vowels and consonants differ from one another as to the elements of which they are composed. For example, it is the difference in the number and the relative intensities of the partial tones which enables us to distinguish one vowel sound from another. The ability to convey ideas by means of vocal sound depends absolutely upon these fundamental differences of speech.

A photograph to be of any value must differentiate the various elements impressed upon the sensitive plate. A photograph of the face should enable us to distinguish the mouth from the nose, eye, chin or ear, otherwise it has no value. In a similar manner a photograph of speech should enable us to distinguish the vowels from the consonants and the various vowel and consonant sounds from each other. A critical study of the two so-called photographs of speech by Dr. Marage discloses no such differentiation.

For example, we have the same regularity of vibration in both vowel and consonant sounds. Some of the consonants show an increase in the intensity of the sound (indicated by the increase in the amplitude of the waves, especially the "p" and the "r," but this is not necessarily a characteristic of consonant sounds. "k," "d," "l," "m," and "n" have absolutely nothing in the photograph to indicate when they occur. The vowel sounds in "au," "cier," "de," "ne," "mon," "a" in "amie," "ie," and "o" in "Pierrot" apparently have exactly the same composition, viz., a fundamental and one overtone. The vowel "u" in "lune" and "i" in "amie" evidently consist only of a fundamental tone. Our study, therefore, shows that there is nothing in this photograph—considered without the accompanying text—which would enable us to translate these wavy lines into speech. It therefore is not a speech photograph.

The apparatus used by Prof. Hallock and myself in studying the voice, and described a few months ago in the SCIENTIFIC AMERICAN, *disclosed the presence of from four to eight partial tones in the various vowel sounds, each vowel having its own particular combination of partial tones. In one photograph the amplitude of the vibrations is greater than in the other. This simply shows greater intensity of the tone. That in which greater amplitude is manifest cannot show any diseases of the throat, as claimed by Dr. Conta, since the same result (intensity of tone) could be obtained by a perfectly healthy throat. It can, therefore, be of no service in diagnosing diseased conditions of the vocal mechanism.*

Prof. Dayton C. Miller of Case School of Applied Science, Cleveland, O., obtained some time ago by his extremely sensitive phonodeik photographs of spoken words as well as tones sung under varying conditions, and his photographs are, I judge, even more tell-tale than Dr. Marage's, for the sensibility of his apparatus seems greater. But although Prof. Miller has analyzed tens of thousands of complex sound curves, he finds the greatest difficulty in analyzing these curves of a nature similar to those here given by Dr. Marage. So that it seems a little optimistic to conclude that these photographs will give to the amateur in mathematical analysis a simple means of determining the necessary corrections in speech and singing voice. There is no doubt that they are illuminating in a general way to anyone who has made a study of the optical analysis of sounds, but I doubt if they can be made of very general and accurate use by the laity.

Up to the present Dr. Marage has not codified the rules which will permit by simple inspection of a vocal photograph to tell the words or the tones which it represents. He has not yet completely deciphered these hieroglyphics of a new type, but without doubt his devices which disclose the least imperfections of speech will help teachers of singing and diction in their often arduous task. Thanks to original combinations of the expert in acoustics, the Mounet-Sully or the Alvarez will easily correct the faults of their pupils, and certain Parisian practitioners—for example, Madam Dr. Conta—already employ it to study the voices of their patients.

The Current Supplement

ALMOST interesting and timely article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2059, for June 19th, 1915, is that which describes the shrapnel shell, of which so much is said in the newspapers, but of which the public has little definite information. This article gives a thorough and practical description and explanation of every part, with excellent illustrations. It is most valuable and readable, and will be followed by other articles describing the various processes of manufacture. The Chemical Industries of Germany cover most exhaustively an important economic subject that affects a very wide range of industries and a multitude of people in many countries. For many years there have been people who have felt that some means might be devised by which all human senses could be pleasantly affected, or gratified, at the same time; and it has been generally accepted that music is the art that lends itself best as a foundation for such a plan. Naturally, the first impulse is to combine the sense of sight with that of sound, and efforts to give a color interpretation of music, along with the audible rendering, have been made on several occasions. The discussion in the article on "The Art of Mobile Color" will be found an exceptionally able discussion of the theories and principles involved. The Science of Cipher is an interesting discussion of the general subject of cryptographs, or illusive writings, with explanations of several systems and methods of deciphering them. In the Earth Considered as a Heat Engine we have a scholarly contribution to the geological history of the world. Another interesting article tells about some of the mechanism employed in moving-picture machines and scientifically describes an unusually ingenious improvement recently made. The use of rubber has become so universal and extensive that the question of supplies is becoming serious. In view of this, the article on the Artificial Production of Caoutchouc is one of commercial and scientific importance. The interesting article on Electrometallurgy is concluded, and there are other articles treating of color sensitive plates, star clusters, and other worth-while matter.

Remarkable Oil Fields in Texas

THE new oil field recently opened up near Thrall, in Williamson County, Texas, with such a remarkable production, is unlike any oil field in the United States, according to a report just issued by Dr. J. A. Udden, geologist of the Bureau of Economic Geology and Technology of the University of Texas, after an extensive investigation.

The peculiarity of this field is the fact that the oil is held in an igneous rock found in the lower portion of clay known as Taylor marl. This igneous rock was probably poured out as a basaltic lava by a submarine volcano in the sea of an earlier age. It was buried under the heavy sediments in this sea and has since changed from a partly glassy block basalt to an impure serpentine which is green. This alteration was doubtless caused by partial decomposition of the basalt or trap rock. While this change was in progress oil probably filtered into the rock, coming from the surrounding marls and clays, which still contain many remains of once living animals, mostly of microscopic size.

From the outcroppings on the surface of this basalt it is surmised that the oil belt extends many miles to the south, then turning west, which belief is supported by the fact that oil has been located in great pools at various points along this belt.

A Metal Famine in Germany

THE London *Daily Telegraph* reports that the *Berliner Lokal-Anzeiger* appeals to the people for contributions of metal to the local mint. Silver is urgently needed owing to the failure of the American supply, and even lead is apparently at a premium. The public is urged to hand in plate, medals, silver ornaments, bottle-stoppers, and even lead soldiers. An office has been established in Berlin for receiving such contributions. The metal thus received is sent to the State foundry at Freiberg, Saxony, where it is cast into ingots and added to the mint reserve. Appeals have been made to the pupils of many schools to sacrifice their lead soldiers for this purpose, a fact which clearly points to the serious dearth of lead in Germany. The only metal not required is scrap iron!

Corn-handling at Carnarvon.—A 30-ton per hour intake plant was recently erected by the Spencer works for a Carnarvon establishment for unloading corn from vessels and delivering it direct into the mill. The elevator is of the balanced girder type and the grain is delivered from the head through a telescopic shoot into a hopper on the quay edge, thence to an underground band conveyor which takes it direct into the mill, where it is distributed by a number of elevators to the various departments of the mill as required. Such plants are of the most improved English design for handling grain in bulk.

The Strategic Moves of the War

By Our Military Expert

FOR another week, despite the entrance of Italy into the great European conflict, the eastern theater of war has been the storm center. The avalanche of Teutons that has been sweeping over Galicia, crushing and grinding or driving ahead of it the stubborn Russian defense, appears to have gained, rather than lost, momentum in its advance. No barrier, whether river, field trench or permanent fortification, has been strong enough to do more than give it a temporary check. The larger part of the spoils Russia secured by many months of hard and persistent fighting, at the cost of hundreds of thousands of lives, has been wrested from her by the Germans in the short period of one month. A great fortified city that withstood a Russian siege for nearly seven months before falling was recaptured in as many days. Considering the magnitude of the forces engaged, the annals of war probably furnish no more brilliant campaign than this German drive through Galicia.

At the beginning of May the Russians were in possession of the Carpathian passes—the doorways into Hungary—and her further advance over the southern plains appeared to be comparatively easy. Her position at that time is shown on the accompanying map by the dotted line. The portion of this position along the Carpathian Mountains ran nearly east and west, while the portion to the north ran nearly north and south. This right angle bend in the line gave German leadership the best opportunity it has had so far to demonstrate whether it is worthy of the faith placed in it. A better place than Cracow, with its splendid railroad facilities, would be hard to find at which to concentrate the enormous force that was to make the drive. It was near to and directly in front of that part of the Russian north and south line which invited attack. Running to the east and connecting Cracow with Przemysl were ample railroads for supplying the driving force during its advance. To the north was the Vistula River, affording a large measure of protection for the left flank of the advancing Germans. And, finally, the drive involved no great risk. If it succeeded the results would be decisive. If it failed, the German strategic situation would be none the worse for the effort. The chances were greatly in favor of success. So great was the opportunity that it scarcely could have been improved had the Germans deliberately led the Russians into the trap.

Driving the Russians out of Galicia.

The advance began about May 3rd. By June 3rd, Gen. von Mackensen, with the assistance of his Austrian allies, had fought his way for 125 miles eastward of Cracow to the full line marked on the accompanying map. The Russians opposed him most stubbornly but unsuccessfully on three successive strong natural lines formed by the Donajec, Wisloka and San rivers. The last of these positions was greatly strengthened by the fortress of Przemysl, but this also was captured, not by slow siege operations, but by impetuous assaults extending over some days, which recall the spectacular taking of Antwerp earlier in the war. In the meantime, the extreme eastern wing of the Russian army in Bukowina was gaining victories against the Austrians on the Pruth and Dniester, in an effort to relieve the pressure on the Russian line in the Carpathians and farther to the north. But the Germans did not permit this to divert them from their main purpose, and the Russian east wing finally became involved in the general defeat and retreated north and east. A united and victorious German and Austrian army is now advancing on Lemberg from west and south.

Why this terrible disaster to the Allies? Aside from the faulty Russian alinement, it would appear that the Russians lost the initiative by the period of inaction that followed their successes up to the taking of the Carpathian passes. Not until the war is over will we know the Russian plan for the conquest of Hungary, but a very probable conjecture is that the activity of the Russian east wing was the first move in a general advance which was to be taken up in succession by the center in the Carpathians and the right wing farther north. For a brief period there was some doubt as to which would hold the initiative—the Russian drive in Bukowina at the extreme east of the line or the German drive in Galicia at the extreme west of the line. The more favorable strategic direction of the German drive was the main factor in leaving the initiative with the Germans.

But we must seek farther for the real reasons for the German victory, and some of the more important of them antedate the war and had their origin in the conference room of the great German General Staff and the council chamber of the German War Lord. The developments of time and the magnitude of the war have given it characteristics quite new in warfare. The German imagination appears to have grasped these, if not perfectly, at least better than that of the Allies. The Allies admit that ammunition shortage was one of the powerful causes of the Russian defeat, and it might be added that an abundance of ammunition for the German guns contributed largely to their victory. German foresight, organization, and enterprise have been sufficient to provide necessary ammunition without the assistance of the outside world so extensively drawn on by the Allies. The German also appears to have realized better than the other contending powers the important part heavy artillery would play in field operations and was prepared for this innovation. To deliver ammunition to the front in sufficient quantity to replace the enormous expenditure of the modern battlefield is a task no less difficult than that of making the ammunition in the first place, and is not possible without an elaborate system of railways, perfectly operated. Truly, this is a war of wits as well as of numbers.

So far the Italian invasion of Austrian territory has furnished us with nothing spectacular. This certainly is not due to lack of preparation by Italy, for she had ample time during the diplomatic negotiations preceding her entry into the war in which to complete all her arrangements for striking swiftly. Nor does it appear to be due to inactivity of the Italian army nor any serious opposition of the Austrian forces on the Italian frontier. Nature is the great ally of the Austrians in this theater of war and the Italians have encountered more opposition from her forces than from Austrian bullets. The Italian frontier was fixed by Austria to suit her own military ends. From Switzerland to the Adriatic Sea it follows the southern or Italian slopes of the numerous chains of the Alps. For many miles (in some places as much as three hundred) back of the frontier line on the Austrian side, one mountain chain succeeds another in a confused mass of precipitous heights and narrow valleys, with few good wagon roads and fewer railroads. Strategically, this frontier is greatly to Italy's disadvantage. It can be crossed only at the mountain passes which can be defended with comparatively weak forces. Between the passes are wide stretches of country, practically impassible to troops operating in large numbers. In short, Italy is confronted with all the difficulties, strategical and tactical, incidental to mountain warfare. The portions of her army advancing through the various passes cannot co-operate with certainty and are in great danger of being beaten in succession before assistance can reach them from the neighborhood forces. In one of Napoleon's early campaigns in this same region he defeated a superior Austrian army when it was divided into two parts not in supporting distance of each other, by attacking each of the parts in succession. The Tyrol is thrust like a dart for a hundred miles or more into northern Italy, and Italian columns advancing through the passes on the edges of this dart must meet on hostile soil before they can work together as a team. This will be a difficult and hazardous operation in the face of a centrally located Austrian force, which can strike the Italian columns one after the other.

The problem of supplying the advancing Italian columns will be most difficult. Not all of the passes have railroads through them or even near to their Italian entrances. To haul the supplies for a modern army over wagon roads for more than a few miles from a railroad terminus, even when the roads are good and plentiful, is a task of such magnitude as to make the boldest commander hesitate. The farther the army advances the more difficult it will be to forward food, ammunition and reinforcements, and when fighting begins the task is increased by the necessity of sending the wounded to the rear. In the passes and within the perimeter of the dart are fortifications that must be reduced and large caliber guns must be supplied in large numbers for this task. This means that vast quantities of bulky ammunition will make further demands on the transportation facilities which may well overtax the capacity of the available roads.

A reverse in such a region may easily become a disaster. A retreating army must pass through the same doorways by which it entered. At the critical time when it is most necessary to concentrate to check a victorious enemy, it may have to separate to save itself. The knowledge that escape from this region is possible only by way of a few narrow passes which may be barred might make an army fight with the courage of desperation, but it may easily have the contrary effect. The dangers of the situation will affect all ranks from commander down. The Russians in the Carpathians were in just such a situation a few weeks ago when the German drive from Cracow began to succeed and threatened to close the Carpathian passes behind them, while they were being attacked in front by the Austrian army. To save themselves they beat a hasty retreat which, for parts of their army, became a rout.

Even with a united army, fighting through these rugged mountains would be a slow and costly procedure. All the modern weapons of warfare must be used here the same as on the gently undulating lowlands. The cavalry cannot be dispensed with, yet it will be next to impossible to support it. Artillery, from the numerous field guns to the fewer but ponderous siege guns, is indispensable, though the guns may be advanced but a mile or so each day. Tactical combinations which will win decisive victories are next to impossible in the face of an active enemy. It probably will be sledge-hammer work, one day after another, success being merely the capture of one mountain fastness only to find the enemy removed to another nearby.

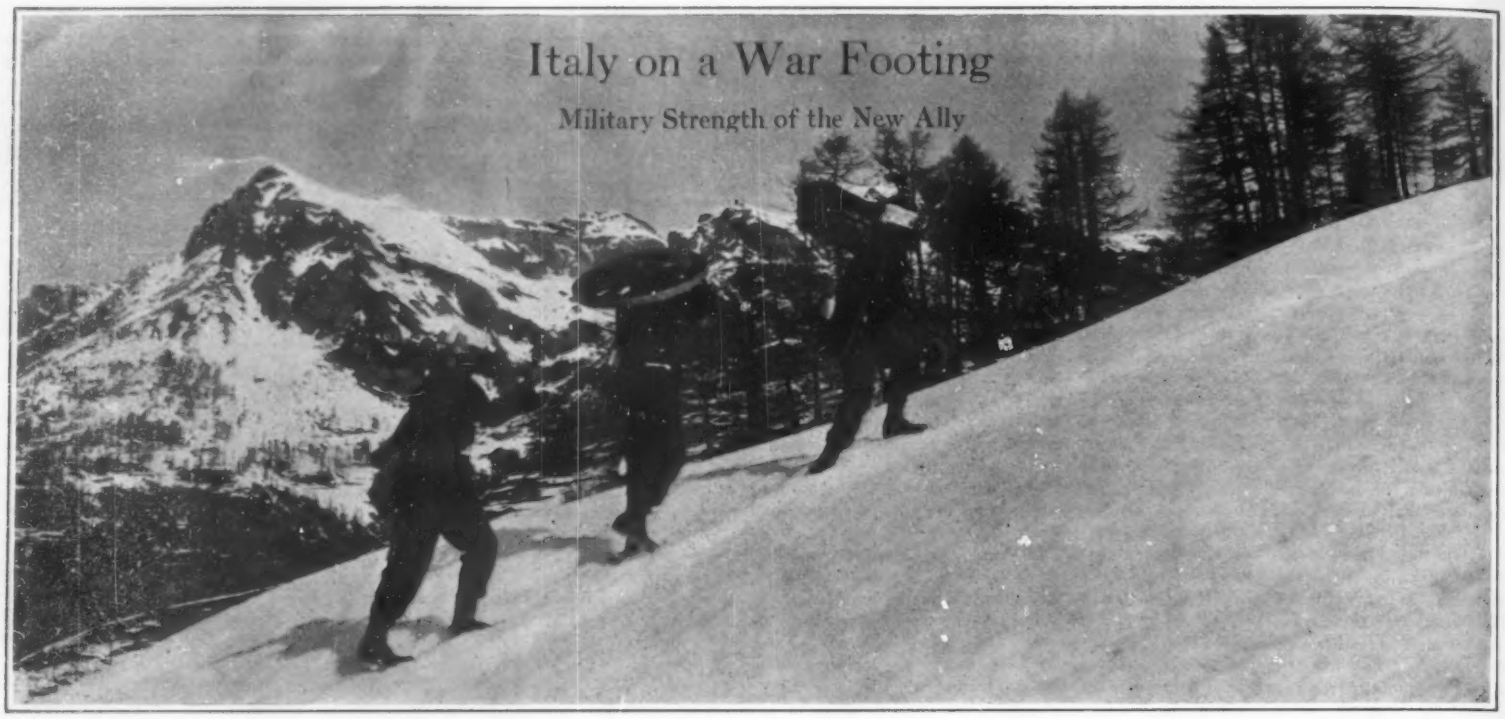
Italy's plan of campaign cannot be determined with certainty, from news had up to now. She appears to be advancing in two directions—to the north toward the Tyrol on a front fifty to one hundred miles wide, and to the east toward Trieste on a more narrow front. Whether or not she intends to advance in strength in both of these widely divergent directions may not be clear to the American reader for some weeks. To do so would mean either much greater strength on the part of Italy than Austria can bring against her, or a determination to take great chances. Certainly she has not yet been opposed by any considerable Austrian forces and probably will not be until Austrian territory is in more serious danger than at the present time.

The contending armies in the west have indulged in another week of whipsawing back and forth, with the advantages on the side of the Allies. This wearing down process, if continued long enough by the Allies and permitted by the Germans, might in time so reduce the defensive power of the German intrenched lines as to permit the Allies to break through and turn the Germans out of a considerable part of their long line, particularly in the north. More probably the Germans will take good care to strengthen their defenses and deliver counter-attacks in time to offset in a measure the advantages gained by Joffre's nibbling policy on the western front.

At the time this is written the German armies are in no great danger at any point and are having matters pretty much their own way in Russia and Galicia. With Russia short of ammunition for her army, which has not yet recovered from the disorganization of its recent disastrous defeats, the Teutons' best opportunity for some time yet appears to be to strike Russia a still more crushing blow, while holding their other opponents at bay with the smallest possible forces necessary for that purpose. At other times in this war the Russian army has shown wonderful recuperative powers, and the immediate hope of the Allies lies in her ability to do this again.

Italy on a War Footing

Military Strength of the New Ally



Photograph by Paul Thompson

Mountain artillery carried on the back.

THE Italian army is based upon a system of universal conscription, its military service being governed by a law passed in 1875. Under this law every man accepted for service served nine years in the Active Army and the Reserve, and for five years in the Mobile Militia, after which followed a period of nineteen years of service in the Territorial Militia. In 1907 to 1908 extensive modifications were made, and at the present time all able-bodied citizens are liable to nine years of service in the Active Army and Reserve (which includes two or three years with the colors), four years in the Mobile Militia, and six years in the Territorial Militia.

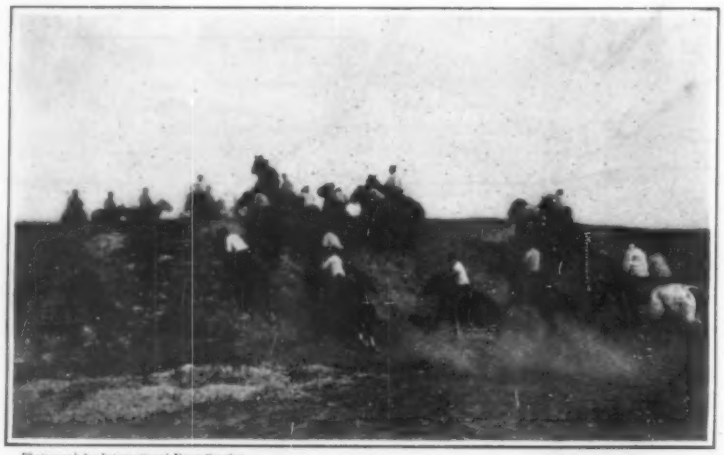
In the year 1901 the war strength of the Italian Army was estimated as follows: Officers, 36,718; Active Army and Reserve, 734,361; Mobile Militia, 320,107, and Territorial Militia, 2,275,631, making a total of 3,330,202 men of all classes. It was estimated, however, that when the re-organization of 1907 to 1908 had taken full effect, which it has done by this time, the Active Army and the Mobile Militia would be increased by about 33 per cent above the figures given for 1901. Hence, at the present time, the field army, including officers, should amount to a little over 1,000,000 men.

The army consists of 14 corps with 26 Alpine battalions; 38 Mobile Militia companies in the second line, and with 26 Alpine battalions in the third line. Behind these are 54 mountain batteries, 6 battalions of carabineri, and 23 battalions of custom guards, with militia formations back of them.

There are four armies in the field, each consisting of two to four army corps and one cavalry division. An army corps consists of two regular divisions, totaling 25,000 men, with 104 guns and 18 machine guns, or two regular divisions and an extra Mobile Militia division, in which case an army consists of 37,000 men, with 134 guns and 26 machine guns.

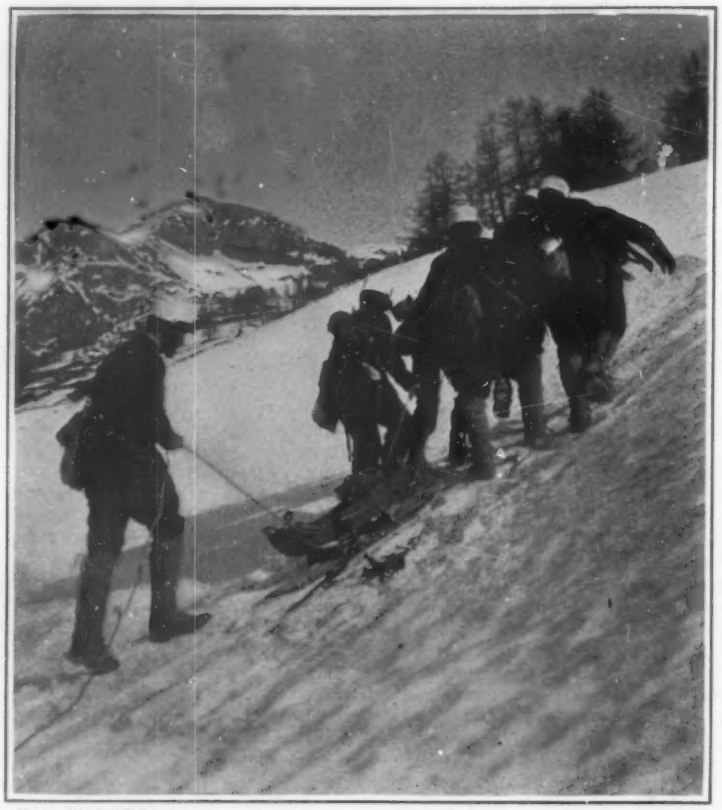
The geography of Italy, considered from the strategic standpoint, makes it necessary that the greater part of the army be stationed permanently within the reach of the northeastern and northwestern frontiers, and the principal headquarters are Alessandria, Milan, Genoa, Verona, Bologna, Ancona, Florence, Rome, Naples, and Palermo. The Alpine battalions above referred to, with the mountain batteries, are, naturally, stationed on the Alpine frontiers.

The infantry is armed with the Mannlicher-Carcano magazine rifle, using a vertical box containing six cartridges. The weight of the rifle without bayonet is 8 pounds 6½ ounces. Its caliber is 0.256 of an inch. The maximum effective range is 2,187 yards. It fires a round-nosed bullet weighing 163 grains with a velocity of 2,395 feet per second, and up to a maximum range of 750 yards the entire space under the trajectory is a danger space for infantry. This is a considerably larger space than that of any other European rifle, that for the English, French, and Belgian rifle being 640 yards, for the Russian rifle 620 yards, the German 610 yards, and of the Austrian 550 yards. It will be seen that the Italian rifle is characterized by small diameter and light weight of bullet, high velocity, and long danger space.



Photograph by International News Service

Italian cavalry is famous for its horsemanship.



Photograph by Paul Thompson

Transporting mountain artillery.

In 1909 the field and horse artillery of the Italian army was in process of rearmament with a Krupp quick-firer; but this gun has been replaced by the celebrated Deport 75-millimeter gun, with some Italian improvements incorporated which they claim have rendered this famous piece even superior to that now in use by the French on the western battle line. The siege guns are of 9-centimeter, 12-centimeter and 15-centimeter caliber, and the howitzers are of 15, 21, and 30 centimeters, the last named being a new gun which has recently undergone tests at Genoa and is said to have shown most excellent results.

The new Italian army has yet to win its spurs under the severe ordeal of modern European fighting. A considerable number of first-line troops are veterans of the recent war against Turkey, but the bulk of the army has yet to receive its baptism of fire. So far as can be judged from press reports, Italy with its four armies of invasion, operating against Trent and Trieste, has been everywhere successful; but the crucial test will come when the Austro-German armies are encountered in full force.

There is reason to believe that the average quality of the Italian army is equal to that of any of the armies engaged in the present struggle. The Alpine troops have long been reckoned among the finest of the mountaineer soldiers of Europe. Equally well known are those picturesque troops known as the Bersaglieri (sharpshooters), of whom there are probably to-day in the Italian army, including those of the Territorial Militia, about 100,000. These troops were originally organized as a corps of sharpshooters by Victor Emmanuel in 1850. They first saw service and greatly distinguished themselves in

the Crimean war, and a detachment of them was aboard one of the Italian warships in the naval battle of Lissa. Their uniform is a dark green, with a felt hat carrying their distinctive badge, a full plume of cock-feathers.

The Italian cavalry has long been characterized for its fine horsemanship, and already it has done good work in the opening campaign on the Austrian frontier.

Italy has this in her favor, that from the very start she will have the advantage of all the valuable lessons which have been taught during the ten months of the present war—lessons as to the relative value of rifle fire, machine-gun fire, shrapnel and high explosive shell attack, and the reduction of permanent fortifications by heavy modern howitzers and siege mortars. It is probable that the Italian army has never been so efficient, well trained and thoroughly equipped as at the present time. During the next few months it will be determined whether Italy is to maintain or lose or enhance her position as a first-class military power.

Copyright by International News Service

Italian field artillery in transit.

Copyright by International News Service

Taking cover behind a bank of snow.

Machine gun drill in the mountains.

Another Motor Truck Problem

IN the issue of May 1st, the SCIENTIFIC AMERICAN called attention to several tendencies in the motor truck industry, which might be considered as indicating the arrival, or at least the dawn, of a new epoch in this important industry. The epoch can, of course, only be considered as such, in the United States; for in Europe, motor truck manufacturers, dealers, and users will find themselves confronted by a situation which, in its very nature, is absolutely unprecedented. The problems due to arise shortly, as a direct result of the great war, in the field of motor traction, will prove the most perplexing and difficult that any industry has been called upon to face since industries existed.

There are at this time something like 50,000 powerful motor vehicles in the armies battling for the mastery in Europe. Of these vehicles, considering the continued replacements and augmentations from the warring countries and from America, not less than 40,000 will be in a shape rendering them useful for commercial work after the war is ended. Careful students of the motor truck problem even admit that the number may be greater, due to the greater experience and greater care shown in the latter part of the war, as compared with the waste and destruction in the first two weeks.

When the war began there were about 25,000 commercial motor vehicles, including the London and Paris buses, withdrawn from service and placed in the field. The majority of these have been returned to their peaceful duties, and new specially designed vehicles have taken their places. What disposition is to be made of the 25,000-odd motor trucks manufactured since the war started, and used for the needs of the armies? To return the trucks to their former owners, against a reasonable compensation, would perhaps be possible in the case of those commandeered, but could not be done with trucks made especially for the army. It certainly could not be done with the 10,000 trucks purchased in the first nine months of the war from the United States. These trucks, overhauled as far as possible by military workmen, will undoubtedly be thrown onto the general truck market.

The total sale of commercial vehicles in Great Britain and France, together, in the course of a year barely reaches 10,000 trucks. If more than twice that number of capable tested motor trucks are suddenly released to be sold at the best price they will bring, one can imagine the chaos which will arise! Neither Great Britain, nor France, nor Russia—and probably not even Germany—would think of retaining all the thousands of trucks used as provision and ammunition carriers. They must be sold! And in the disposal of these vehicles in such an enormous number, compared with the total number in active work before the war, lies a menace to the European motor truck makers, which even at this time is causing the gravest apprehension. There will be few motor trucks exported from the United States—when the war ends!

Photograph by Modern News Service

The Italian 75-centimeter field gun.

Copyright by International News Service

Cyclist detachment of the famous Bersaglieri.

Electromagnets for Experimental Work

MUCH time is often consumed in making electromagnets for experiments. It often happens that a large attractive power is not needed, and in this case it is an easy matter to make up an electromagnet, especially if there is a good current supply at hand so that the magnet need not have a great number of turns. Take a good-sized galvanized or other soft iron wire (about one eighth or three sixteenth inch) as a core. Were it bent as a horseshoe, it would be very hard to wind, but all that is needed is to insulate each end with paper and then wrap on rather fine wire without the use of a spool. After winding, bend the whole so as to make the usual U-shape. Although small, such a magnet has power enough for many usual purposes.

Metallized Cartridge Shells

BY the Schoop process, as has been described quite fully in the SCIENTIFIC AMERICAN, metal may be sprayed upon an object to form a thin plating or coating. This process is now being used in the manufacture of cartridges for rifles. Instead of using a solid metallic shell, paper cartons are employed, and these are covered with a thin layer of metal. Aside from the saving in copper or brass, the cartridge itself is lighter, so that a soldier can carry more of them than the old type.

A Novel Dissolving Picture-projecting Apparatus

By Robert G. Skerrett

UNTIL very recently the trick of showing dissolving views by means of a stereopticon was pretty much a matter of sleight-of-hand. The operator in charge of the machine had to shift his slides manually, and the success of the effect hinged entirely upon his cunning of manipulation. In this age of mechanical wonders a procedure of this sort seemed exceedingly antiquated—at least that is the way the situation impressed Mr. Alfred Vischer, Jr., an undergraduate of Stevens Institute.

Being of an inventive turn of mind, this young man set about planning an automatic apparatus for shifting the slides and operating the shutters of a stereopticon. When far enough along, he laid his design before an established manufacturer of picture-projecting machines, but the latter declared the scheme impracticable. Coming from doggedly Dutch ancestry, Mr. Vischer decided to build an experimental outfit, and from that first endeavor has evolved his autoprojector, a commercial apparatus now generously endorsed particularly by advertisers.

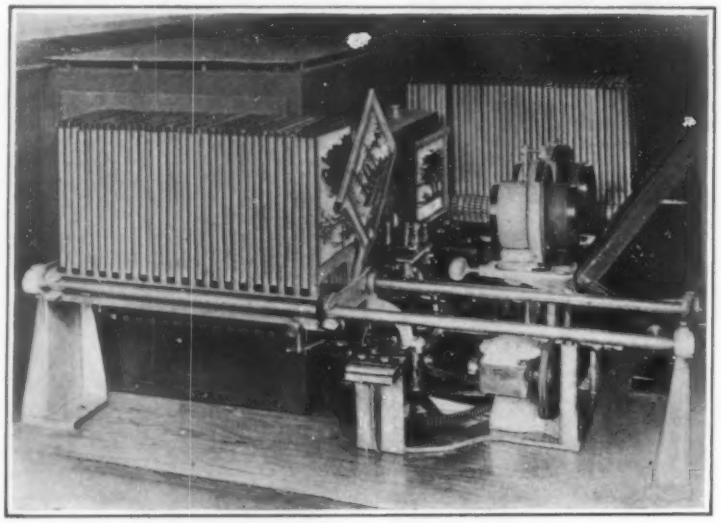
The inventor's first aim was to produce a machine for the lecture platform, but the immediate field of picture advertising made the stronger appeal. His outfit for the lecture platform is fundamentally like that for publicity work, except that the lecturer controls the period of exposure for each plate and, by merely pressing a button, can make the apparatus show again the picture immediately preceding the one at the time on the screen. This feature is a valuable one, and the confusion so often encountered where the slides are operated by hand is entirely eliminated.

Primarily, the machine consists of two flanking racks holding slides in pivoted aluminium frames which alternate in the order of display. Or, in other words, the odd numbers are on one side and the even numbers on the other. In turn, the slides are swung in a vertical plane across the face of the projector, each set of slides having its own lens, and as the shutter of the view already shown is closing, the diaphragm for the new picture is opening. In this fashion the dissolving effect is obtained gradually and smoothly and with perfect regularity. The slides cannot be dropped and the mechanical movement is so nice that there is not the slightest jar or vibration. The carriages containing the aluminium holders advance much after the manner of a typewriter carriage, and this progression is effected by gearing.

In the case of the lecture apparatus, the action is started by the pressing of a button and the picture remains upon the screen until the button is again pressed for the next slide or, as we have already said, for the reproduction of the previous picture; then another button in the same hand bulb is pressed. The disappearing of one view and the coming of another gives the dissolving effect. With the advertising machine, however, the period of display is uniform for all the slides, and they are shown continuously in any desired order so long as the apparatus is working. The actuating current is subject to automatic control, which can be set to stop the machine at any hour. This is particularly desirable where advertising is carried on after closing hours for the shops or other places of business where the apparatus is placed in the windows.

The autoprojector for advertising can handle any number of slides from ten to seventy-four, and the carriage feeds slides when advancing and retreating. By suitably alternating the holders to be brought into play, a circular succession, as it were, of the slides can be maintained continuously, thus insuring that the views shall follow in their logical or designed sequence. This is important, especially when the aim is to arrest the attention of the passerby and to show him the climacteric points in the story to be told graphically.

Mr. Vischer calls his outfit "movies for the advertiser," and his aim is to eliminate the progressive stages of the ordinary movies, which he terms lost motion, and to show those striking moments toward which the mind instinctively leaps. The operative cost is very modest, the maximum—depending upon current cost—would be about 8 cents an hour. The machine functions noiselessly, weighs complete about 75 pounds, and is compact. The autoprojector, when resting upon its stand, is something like 6 feet high, and calls for a floor space of less than 2 feet square. A 22-inch picture is thrown upon the screen, and the illumination is sufficient to make daytime projection vivid.

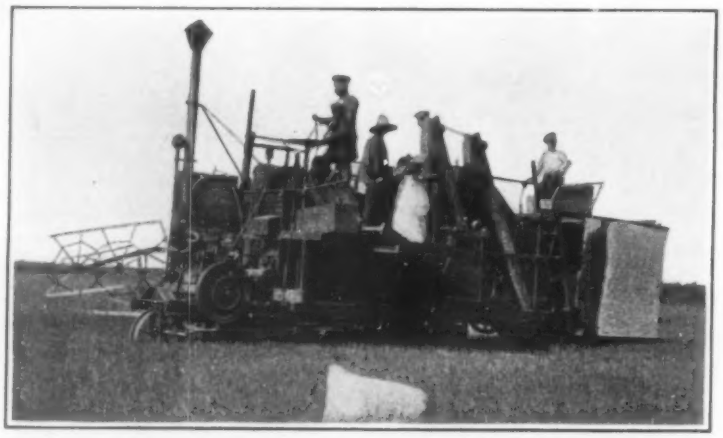


The inner mechanism of the autoprojector, showing the lantern slides and holders, the guideways for the carriages, and the double lenses.

A Home on Two Wheels

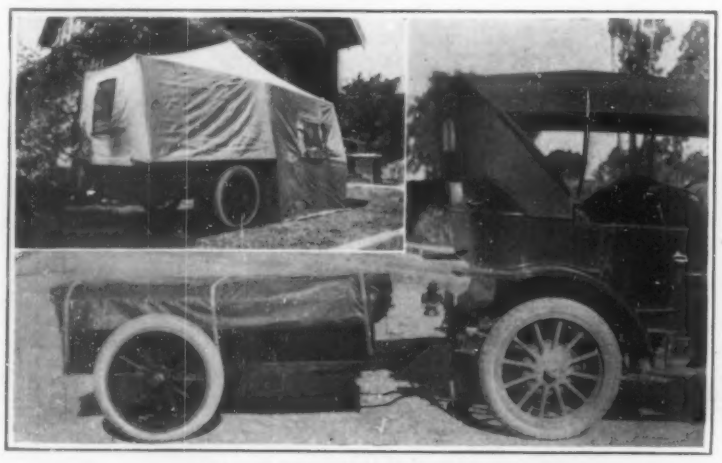
A LARGE tent house that can be folded up into small compass and trailed behind an automobile on a two-wheeled trailer has been devised by a Los Angeles inventor. Although it makes a commodious camp house with complete equipment for cooking and sleeping, yet every detail is so scientifically arranged that a very portable load is made of the parts within a few minutes after striking camp.

The trailer contains a tent, chairs, stove, ice-box, a table set complete, numerous cooking utensils, etc. The sleeping accommodations consist of one full-sized bed with mattress and two folding cots. The tent is rainproof, measuring 13 by 5½ by 8 feet high. It has three windows with screens. The ice-box contains five separate compartments, one for the ice, 10 by 14 inches; another contains a two-gallon water can. The camp house is electrically lighted. In fact, there are so many comforts of home that one can take an outing trip without any of the "roughing it" that one hears about in connection with such a trip.



A harvester in Kief, Russia.

An internal combustion engine supplies power, and the machine, propelled by a caterpillar tractor, cuts, threshes and sacks the grain.



Camping outfit for motorists adapted to be carried in a trailer.

Harvesting Grain by Motor Power

YEARS ago, when the establishment of the grain raiser of the West grew from a modest farm of a few hundred acres to the immense ranch where it took an entire day to run a single furrow around a field, it became evident that the old-fashioned hand methods of plowing, reaping and threshing were entirely inadequate, not only because of the cost, but more especially because it was impossible to find enough men to do the work. This condition was met by the reaping machine, which later became a header, and was also combined with a thresher, thus evolving a harvesting outfit of great capacity.

These combinations were heavy to haul and also required considerable power for the various mechanical operations, and with increased demands for service the simple reaper requiring two horses grew to a huge machine drawn by thirty powerful animals; and here the limit in size and efficiency practicable with this kind of power appeared to have been reached. The steam engine appears not to have been suitable or desirable as a substitute for horse power, and even when the internal combustion motor became practical its use was confined to the operation of the mechanism but not the propulsion of the machine. All of this has now been changed by the improvements that have been made in heavy traction devices, and the latest harvesting apparatus is the complicated machine shown in the illustration that does everything but grind the grain which it gathers.

Harvesting that is almost automatic is now possible by means of a self-propelled combined harvester which has reached the commercial stage. Since the early eighties, when a header and a thresher were combined to make the horse-drawn harvester, three other machines have been incorporated, viz., a recleaner, a gasoline engine, and a "caterpillar" track, which propels the outfit forward.

The heads and a short section of the straw are cut by the header knife falling upon the draper, an endless canvas belt which elevates them to the feeder. Back of the feeder, a rapidly revolving threshing cylinder knocks the grain out of the heads. Revolving beaters, pickers, and endless straw carriers continue the separation, finally throwing the straw out at the rear of the machine, either in large bundles or a continuous windrow. The grain is elevated to the cleaner, thence delivered into sacks, which are still sewed by hand, and dumped six in a place on the ground. Unthreshed heads go back to the feeder for a second trip through the cylinder.

The separator is kept level on steep hillsides by a swinging frame which permits one wheel to be dropped and the other raised, the header meanwhile conforming to the slope of the hill, sometimes over 45 per cent. The gasoline motor was first added to horse harvesters to maintain a steadier motion for threshing, regardless of the forward progress of the outfit, and to reduce the animal power required. In the self-propelled harvester it, of course, furnishes power, not only for the cutting and threshing, as before, but also for propulsion.

Four men operate the self-propelled outfit, one driving, another tending the header, a third the separator, and a fourth sewing sacks. They put as much wheat into the sack in ten hours as six hundred men working with scythes and flails, with a considerable advantage in cleanliness of output.

The use of the motor and endless steel track for propelling eliminates from sixteen to twenty-six horses.

Combines have been common on the Pacific coast for thirty years, but the self-propelled machine is a commercial novelty within the last two.

Removing a Statue From the Course of a Subway

THE new subway running across New York through Fifty-ninth Street passes under the site of the Sherman monument in Central Park Plaza. The weight of this statue and base was over three hundred tons, and it was found necessary to move the statue, as the rock formation above the roof of the subway was not strong enough to support the load.

The moving of this massive piece of sculpture a distance of 195 feet was effected without the aid of steam, electric or horse power, but merely by hand labor. The preliminary operations consisted in the removal of the granite steps surrounding it and the raking out of the mortar in all joints of the pedestal to a depth of at least an inch, in order to prevent spalling, that might be caused by excessive stresses, in the stones during the moving.

Upon completion of this work the foundation was cut out below one end of the granite pedestal, enough to permit the placing of a transverse needle, consisting of a pair of 12-inch I-beams bolted together. These needles were supported on jacks at each end and were brought to a bearing under the pedestal. An adjoining section of the foundation was then removed and a second pair of I-beams inserted and jacked up, and this operation repeated until six pairs of I-beams had been set. The monument was then raised, by means of the jacks, to a height sufficient to permit the placing of skids and rollers.

The skids upon which the monument was moved consisted of two sets of three 15-inch I-beams each, bolted together, placed longitudinally under each side of the monument. Over these, two 15-inch I-beams, bolted together, were placed longitudinally along each side to support the ends of the needle beams. Twelve 5¼-inch steel rollers were then placed between the upper longitudinal beams and skids. The skids were then wedged up and brought to a bearing and the jacks removed.

Two differential pulleys anchored some distance ahead were used to move the monument on the rollers. Two men to each pulley operated the windlasses on which chains revolved. In this manner the monument was moved to its temporary position over a concrete foundation which had previously been placed for its support.

Two pairs of 15-inch I-beams were then placed lengthwise along each side of the monument above the transverse pairs of I-beams; and the latter hung from these by means of 3-inch I-beams placed above the longitudinal and below the transverse I-beams and connected by 1-inch bolts.

The load was then transferred to jacks placed under the upper pairs of longitudinal I-beams, and the lower sets of longitudinal I-beams and the skids on which the monument was moved were removed. The monument was then lowered, by means of the jacks, to the required grade. Supporting piers of granite were then built under the monument and the load transferred to the piers by means of wedgestones. The jacks and needle beams were then removed and the granite steps replaced.

The monument jacked up on the new site while the skids were being removed.

Moving the monument on rollers.

Laying the skids on which the monument was moved.

Swat the Fly Eggs

"SWAT the fly" is a good war cry; but it is like locking the stable after the horse is stolen. There is a better one—"Swat the eggs." Probably every magazine and newspaper in the United States printed last season from one to a score of arraignments of the common house fly—the disease-breeder, the typhoid fly; the infantile paralysis fly; in a word, the twentieth century pest, an enemy of mankind. "Swat the fly" has become the slogan of the day.

For every fly killed in May there will be ten thousand less in June, a million less in July, and by September the most ambitious boy, eager to earn the prize for the greatest number of flies killed, couldn't possibly lift the progeny of this single fly which escaped him in the springtime. All very true; but where will all these flies lay their eggs and rear their precious babies? Can we find the nests, can we destroy them by wholesale, the larvæ or the eggs? We can, easily and cheaply, and every city with ordinary regulations may become a flyless town. Flies breed in filth, principally manure, and the ordinary pile of stable manure will bring forth enough flies to keep five hundred families fighting the pests from morning till night. If one tenth of the money invested in fly screens were spent on killing fly eggs laid in manure piles and garbage cans there would be no need of the fly screens which keep out the flies and incidentally a large proportion of the cooling breezes of summer.

Our Government has carried on an extensive experiment with manure piles and the eggs which each female fly deposits therein by the thousand, and has found the remedy. It is ordinary borax, one of the commonest and cheapest of minerals, produced in abundance in the United States, and it takes very little to make the fly egg quite worthless as a future fly. Borax costs about five cents a pound, and the crude borax mineral, colemanite, considerably less, while three fifths of a pound sprinkled through 10 cubic feet—about eight bushels—of manure will kill 99 per cent of the eggs and maggots of the fly.

A long series of experiments looking to the destruction of fly eggs and fly larvæ in manure piles has been carried on under the direction of Dr. L. O. Howard, the entomologist of the Department of Agriculture, the manure being treated in boxes or cages, the collection of these resembling a group of huge beehives. The manure, well infested with fly eggs, was treated with borax, kerosene, potassium cyanide, formaldehyde, copper sulphate, Paris green and ten or a dozen other chemicals, but none gave satisfactory results except the borax. Strangely enough, the Isthmian Canal Commission larvicide, consisting of carbolic acid, resin, caustic soda and water, which kills mosquito larvæ in less than half an hour, had but slight effect upon fly larvæ.

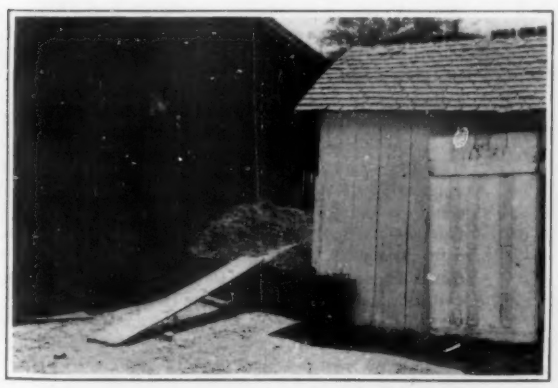
An important consideration in the borax treatment is in the effect on the manure. Some of the chemicals tested rendered the manure dangerous as a fertilizer, making it more harmful than beneficial to plant growth, but borax not only makes the manure possibly more beneficial as a fertilizer, but prevents burning or firefanging, a natural process with ordinary manure piles which considerably reduces the fertilizing effect.

The borax treatment is simplicity itself. Dr. Howard's advice is to apply 6 to 10 pounds of borax to every eight bushels of manure immediately upon its removal from the barn, sifting the borax around the outer edges of the pile with a common flour sifter and then sprinkle a large watering pot full of water over it. The flies lay their eggs on the fresh manure and the borax when it comes in contact with the eggs prevents their hatching. The few eggs which do hatch into maggots will soon or later encounter the borax, too, and die. The treatment should be repeated with each addition of fresh manure, since the eggs hatch out in one day, but remain in the manure as maggots for several days more. When the manure is kept in closed boxes or pits less frequent applications will suffice. Refuse and garbage should be treated in the same way. The cost of manure treatment is figured at one cent per horse per day.

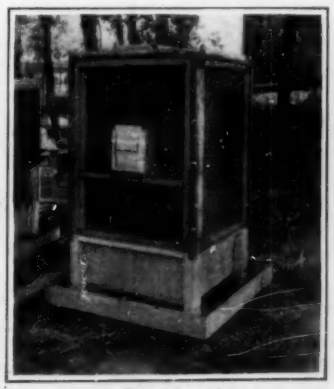
The borax treatment is so simple, so effective, and so inexpensive and so small a burden on the individual, that any community can enact and easily enforce regulations which will leave the fly without a breeding place; hence there will be no flies to swat.

Feeding the New-born Infant

IN the light of some experiments on the energy requirements of new-born infants, studied in a respiration incubator, it is claimed by H. C. Bailey and J. R. Murlin that the breast secretion should be supplemented with artificial food during the first three days of life, as until the fourth day it is inadequate to supply the energy required by the infant. The respiratory quotient of the infant whose food is not thus supplemented shows a condition of starvation, with the combustion of fat, on the second and third days. Hence it is stated that "feeding the new-born infants for the first three days, in addition to the breast secretion, a formula of about the same composition as colostrum would appear to be a logical proceeding, not only to fulfill the energy requirement, but also to supply the water lost."



Millions of flies breed in this small manure pile.
A few pounds of borax would destroy this fly nursery.



Cage used in the chemical treatment of manure.

Manure piles used in tests of fly larva destruction.
1. Treated with dry borax. 2. Borax solution. 3. Not treated.

Inventions New and Interesting

Simple Patent Law : Patent Office News: Notes on Trademarks

A Remarkable Intermittent Mechanism for Motion Picture Projectors

By W. B. Morton

IN the production of motion pictures advantage is taken of the characteristic of the eye known as the persistence of vision. There is no actual motion of the rays of light forming the picture on the screen at all. Indeed, it may be said that to obtain perfect motion in the picture the film must be held perfectly still.

The motion picture film consists of a series of successively taken photographs of such small size that on a reel of standard length there are approximately 16,000 pictures, each differing from its predecessor by so small a difference that it is difficult to measure and quite impossible to observe by mere comparison.

By the operation of the motion picture machine the film strip is fed intermittently across the path of light of the arc lamp in such manner that each picture is brought to rest in the focal plane of the projecting lens, while the light from the lamp is cut off from the screen by the shutter of the machine and is maintained at rest for a definite period in which the shutter, usually a continuously rotating blade, uncovers the lens, makes its revolution, and again intercepts the light during the interval in which the film is advanced to bring the next picture into place.

The smoothness and exactness of operation of the intermittent gearing which drives the film feed directly determines the quality of the projection, as the "definition" of the picture depends chiefly on the exactness with which each picture is registered with the position of the preceding picture. An inequality of less than 1/10,000 of an inch in the engaging parts of the intermittent gearing can be distinguished in the appearance of the picture on the screen.

Not only must the intermittent be absolutely exact, but the experience of the first inventors in this field demonstrated the desirability of having the period of illumination as long as possible and the period of movement of the film as brief as can be obtained within the limits imposed by the fragile nature of the film and the speed of operation.

Prior to the invention by Mr. Nicholas Power of the recently patented intermittent gear forming the subject of this article, the greatest relative period of rest was three times the duration of the period of motion obtained with the well-known 4-slot Geneva gear (Fig. 1).

The next Geneva gear in ratio of rest to movement is the 5-slot Geneva gear. This gear, shown in Fig. 2, gives a period of rest four times as long as the period of motion, the total movement of the film taking place in one fifth of the time of complete revolution of the driving member. Hence, as pictures are exhibited sixteen to the second, the entire period of movement for each picture must be completed in 1/80 of a second.

Experience demonstrated that neither the film nor the machine would stand up with this movement, and as there is no Geneva between the 4-slot and 5-slot, it was believed that with the 4-slot movement the final development had been reached and for a number of years prior to the production of the Power movement, it was the intermittent movement of all commercial machines.

Mr. Power's first idea in developing the new intermittent was not so much to improve the Geneva gear as a type, but to produce a gear which would have a ratio between the two Geneva gears, and thereby obtain a greater period of rest of the film than the 4-slot Geneva without the destructive action of the 5-slot gear. The final result, however, of his study and experiment far exceeded his expectations; for in his latest model he has produced a gearing which has a longer period of rest than the 5-slot Geneva, and which nevertheless actually produces less wear on the film and less vibration of the machine than the 4-slot Geneva.

This form of gearing is shown in Figs. 3 and 4, and comprises a rotating driving member having a locking ring or flange extending throughout the greater portion of its circumference with a diamond-shaped driving cam in the gap intermediate the ends of the locking ring. The driven member, known to the trade as the "pin cross," comprises a 4-arm cross, each arm being provided with a pin to be engaged by the driving cam and locking ring. Each part is formed from a single block of drop forged tool steel to insure durability and reduce wear to a minimum.

The operation of the gear is shown graphically in Fig. 5, which shows different successive positions of the parts in a complete movement. In locking position all four pins of the cross engage the locking ring, two on each side as shown at position 1 of Fig. 5. As the diamond-shaped cam starts to pass between the pins of the cross the outer pin is engaged by the slightly curved outer face of the diamond, which produces the initial rotation of the pin-cross and causes the pins on each side of the pin to be engaged by the diamond into the slots between the driving cam and the locking ring as shown at position 2. The cam action of the inclined slots on the pins continues the movement of the pin cross through the various stages illustrated, giving the driven member of the intermittent to which is attached the film feeding sprocket an exact quarter revolution, at which point the locking ring is again engaged by all four pins, thus holding the pin cross absolutely stationary during the period of rest of the film.

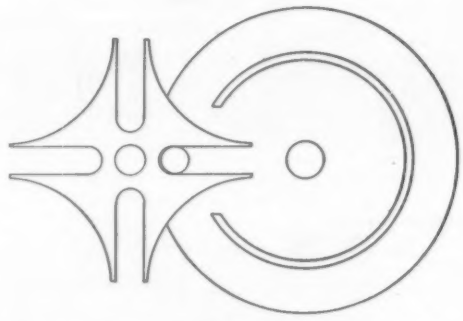


Fig. 1.—The standard four-slot Geneva movement of motion picture projectors.

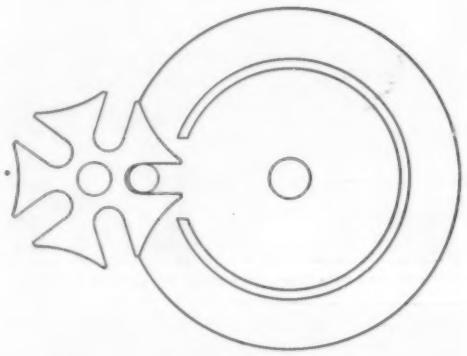
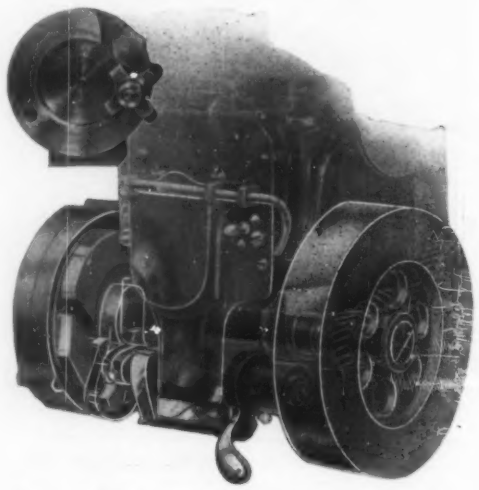


Fig. 2.—The five-slot Geneva gear, which gives a motion picture film a period of rest four times as long as the period of motion.



Figs. 3 and 4.—The new Nicholas Power intermittent movement for motion picture projectors.

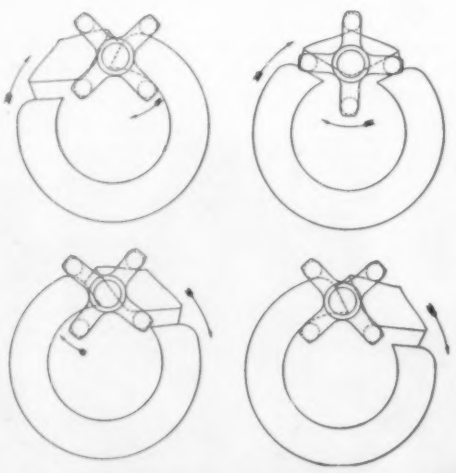


Fig. 5.—Successive positions of the parts in a complete movement of the Power intermittent motion.

The movement of the pin cross takes place during an angular movement of approximately 70 degrees of the cam, thus giving a period of rest even greater than the 5-slot Geneva, and yet it has been proven by a very interesting demonstration given at the recent Motion Picture Exhibition at Grand Central Palace that the new movement produces much less wear on the film than the 4-slot Geneva of other machines with the 90 degrees period of movement.

The reason for this superiority is that the new movement has been designed to give to the driven member an absolutely uniform acceleration in speed starting from its position of rest and an absolutely uniform retardation back to locking position, so that the driving power required is the same throughout the entire period of acceleration. In other words, the new gear utilizes the entire period of operation to the maximum degree, whereas the Geneva gear, which has a slow rate of acceleration at the start of the movement and also at its period of greatest velocity, must make up for these periods of understrain, when the rate of acceleration is small, by an intermediate period of severe overstrain in order to accomplish its full movement in the allowed period of time. In designing the new gear Mr. Power has adapted to the rotative movement of the intermittent gear, the laws of movement of a freely falling body whose velocity increases uniformly in successive periods of time under the force of the weight of the body which, of course, remains constant during its entire downward movement.

In the projection of motion pictures the new Power intermittent accomplishes three notable results. Its longer period of rest allows a longer period of illumination of the screen with brighter pictures and greater definition as well as less consumption of lighting current. Its uniform action produces less vibration of the machine, increasing the steadiness of the picture to a marked degree. Finally, the important fact of its easy action on the comparatively fragile film extends its life and usefulness.

Readers of this article who wish a more detailed analysis of this remarkable mechanical movement and a curve comparison of the time relations in the standard and the new Power intermittent gears, are referred to the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2059.

A Long Delayed Application

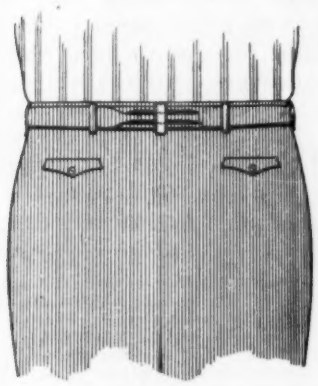
THE Court of Appeals of the District of Columbia has had under consideration an *ex-parte* Patent Appeal in which probably a record case of time in the Patent Office is involved. The patent application, the subject of this appeal, was filed in the Patent Office in 1880. As one of the counsel suggested at the argument, the application was in the Patent Office a period equal to or in excess of the succeeding terms of two patents, the patent term being seventeen years, while the application has been in the Patent Office more than thirty-four years. Incidentally, there was raised the bearing upon the application of an expired patent, the application for which was filed subsequent to that of the application in question. It does not appear that there could be an interference, and the extent to which the patent could be held a constructive notice to the applicant is subject for argument. The present Commissioner's endeavor has been to avoid the delays in applications, and during the argument of the appeal in question counsel asserted that there had been consumed 50 per cent more time by the Patent Office in acting on the merits than by the applicant in replying to the official objections, a rather unusual circumstance in delayed applications of this character.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

WAIST BELT.—L. RECHTSCHAFFEN, 441 E. 119th St., New York, N. Y. This invention provides a belt for use on trousers and other garments and arranged to enable the wearer to readily open and close the belt and to allow of



WAIST BELT FOR TROUSERS, ETC.

adjusting the belt with a view to draw it more or less tight around the waist to suit the convenience of the wearer. The belt is made in sections and preferably of the same material as the garment.

Pertaining to Aviation.

AEROPLANE BALANCE.—G. MEZZATESTA, 170 E. 61st St., New York, N. Y. This invention refers particularly to means for balancing the aeroplane automatically. It provides a structure which may be easily thrown into operation and out of operation, and when in operation to automatically maintain the aeroplane in the course being followed.

Electrical Devices.

WIRELESS TRANSMISSION OF ELECTRIC ENERGY.—R. C. GALLETTI, 18 Cranley Place, London, S.W., England. The main object of this invention is to provide means for transmitting electric energy at a distance without connecting wires, and the inventor has found that such means permit the reception of signals at a distant receiving station directly by an indicating device without the interposition of a detector or its equivalent.

Of Interest to Farmers.

MOWING MACHINE.—C. LORENSON, Box 138, Davenport, Iowa. This invention provides means for raising the finger-bar and knife-bar and maintaining them raised, horizontally or at an angle; means for taking up the drag of the finger-bar; means for avoiding side-draft; means for protecting the pitman from tall grass being bent thereover; means for directing grass away from the shoe carrying the finger-bar to the knife-bar; means for varying the speed by means of sprocket wheels of various sizes; and means for special work.

SANITARY ATTACHMENT FOR MILK PAILS.—J. T. WILLIAMS, 421 Navarro St., San Antonio, Texas. This attachment for milk pails prevents access of dust, dirt, or noxious germs to milk during the milking operation. It comprises short open-end sleeves or tubes made of canvas or other suitable flexible material and provided with a lengthwise slit to receive the hand of the milker, and also with a finger loop for use in supporting the sleeve during milking.

CATTLE GUARD.—I. LAWRIE and D. F. BRAZEL, care of H. M. Layton, Box 16, Thaba Nehu, Orange Free State, S. Africa. This invention relates to cattle guards adapted to be placed between the rails of a railway track adjacent to a crossing, and at the outer sides of the rails, to detect cattle from taking the direction of the track. It provides a cattle guard having novel guard elements so supported as to have marked instability to the tread of the cattle.

MILKING MACHINE.—L. P. PATTERSON. Address W. B. Laroutte, Carthage, Mo. An object here is to provide a system for automatically milking a number of cows and delivering the milk to containers ready for shipment. Another, is to provide in a machine a pneumatically operable pulsator carrying teat cups and including means for providing an intermittent direct cut-off to the cups, whereby to periodically relax the teats.

Of General Interest.

EXPLOSIVE BARRIER.—G. E. ELIA, 16 Via Ludovisi, Rome, Italy. This invention provides an explosive boom for the defense of ports and similar purposes, and it has more particularly in view to insure the explosion of at least one of the boom elements on the boom being crossed by a running vessel, said explosion occurring, namely, if the vessel possesses a flaring bow (sliding vessel) which enables it to pass over the boom.

DEVICE USED IN THE FORMATION OF JETTIES.—E. E. EVERETT and D. F. SHELDON. Address Don G. Bowker, Attorney, Ventura, Cal. This invention relates to jetties for rivers or other flowing streams, and more particularly to an improved element or unit adapted to be used in the construction of the jetty. The principal object is to provide a device which may be used as an element or unit in forming a jetty, and which will overcome the disadvantages accruing to forms used in jetties and those of a similar nature.

Hardware and Tools.

HAMMER.—V. T. LYNCH, 3826 North Racine Ave., Chicago, Ill. Mr. Lynch's invention relates to means for nailing objects together, such as laths, shingles, siding, etc., to suitable supports, covers on boxes, etc., and one of the main objects thereof is to provide an imple-

HAMMER.

ment which automatically makes a nail and holds the same in position for driving. It provides means for feeding wire for the nails from a coil or the like; also for insuring the feeding of the same length of wire for each nail formed and driven.

Household Utilities.

TOILET APPLIANCE.—J. A. F. DANNER, 951a Elizabeth Ave., Elizabeth, N. J. The invention relates to mechanical means for using toilet paper in connection with water-closets, and provides such means which obviate the usual manual manipulation of such paper. It provides such means which are operable entirely from the exterior of the bowl of the closet.

FAUCET FILTER.—J. BOULARD, care Fred. Griffin, 25 Beaver St., New York, N. Y. This invention relates to a filtering device which is adapted to be used in connection with various types of faucets whereby water can be drawn off free from sediment and deleterious matter and at a comparatively fast rate.

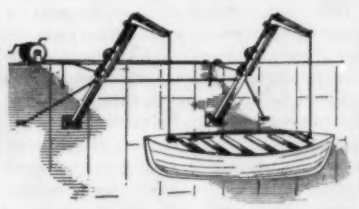
Machines and Mechanical Devices.

PAPER HANGING DEVICE.—J. N. CAMPBELL, Linden, N. J. By use of this device paper may be placed directly on the wall or on the ceiling from the supply roll. The device is comparatively small so as to be readily operated by a workman and raised from the floor

PAPER HANGING DEVICE.

to the ceiling when placing paper on the wall, and readily moved across the ceiling when placing paper thereon, the same being formed so as to apply the paste to the paper as it is placed on the wall.

DEVICE FOR LAUNCHING LIFE BOATS.—R. W. LEEMING, Brantford, Canada. The object here is twofold—first to retain and improve the present method of launching by which the boat is let down close to the ship, a method which does fairly well on a smooth sea, but is dangerous in rough water, panic or other emergency. Secondly—by the same mechanism to launch the boat from fifteen to twenty feet away from the side of the ship. An improvement is effected even when launching close

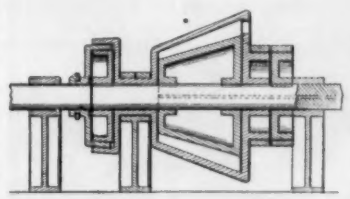


DEVICE FOR LAUNCHING LIFE BOATS.

alongside, the old-fashioned davit blocks and ropes being replaced by a single cable from the winch to each davit. These cables are both wound on the same winch drum, which expedites lowering the boat and ensures its being let down on the level. But if the sea is rough, then with the same apparatus the boat may be swung out clear away from the side of the ship, as shown in the engraving.

Prime Movers and Their Accessories.

TURBINE.—G. W. CRAWFORD, Route 3, Fremont, Mich. The object in this case is to provide a device wherein the two elements of the turbine are mounted to rotate, and wherein other mechanism is provided for fixing either

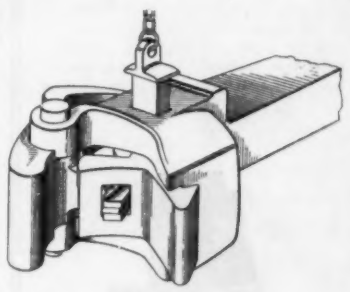


TURBINE.

of the said elements, to make the said element the stator and the other the rotor, and wherein clutch mechanism is provided for permitting either of said elements to be connected to the driving shaft.

Railways and Their Accessories.

AUTOMATIC CAR COUPLING.—C. H. STARK, Room 924, Colorado Bld'g., Washington, D. C. The primary object in this invention is to provide a car coupling strictly in keeping with the present type or style known as the Janney type or Master Car Builders' coupler,

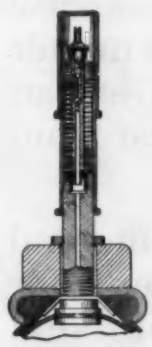


AUTOMATIC CAR COUPLING.

but possessing new and improved characteristics, such as will eliminate the necessity of persons going between the cars for the purpose of opening the knuckle or placing any part of their body between the cars in order to adjust the knuckle or coupler head.

Pertaining to Vehicles.

VALVE.—A. JAQUISH, Ontario, Ore. This invention has reference to air valves, such as used in pneumatic tires, and the main object thereof is to provide a valve which automatically prevents a blow-out due to too great



PNEUMATIC TIRE VALVE.

pressure within the tire; and a further object is to provide means, in connection with such safety device, for determining the extreme pressure which it is desired to have within the tire.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

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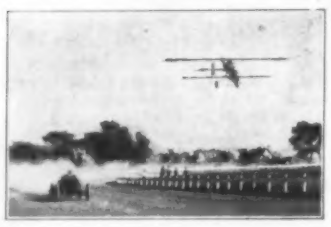
GRAFLEX CAMERAS

You can make snapshots indoors if you use a Graflex Camera. This picture was made indoors with the shutter set at 1-35 of a second. The negative had plenty of exposure, and the shutter operated fast enough to prevent the movement of the children from spoiling the picture.

No camera equals the Graflex for high speed photography. In this picture both the automobile and biplane were going at a very high rate of speed. This made it necessary to set the shutter at 1-1000 of a second to get a picture that was clear and distinct.



Photographs in the deep woods or in the shade offer many difficulties to those who are not equipped with a Graflex Camera. With the Graflex you can make pictures under light conditions that make photography impossible with cameras of the usual type.

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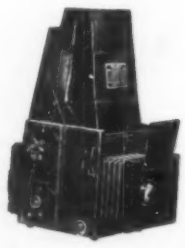

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"A protest on the *Lusitania* case from little Switzerland is a matter far more serious to the German Government than a protest from us," writes Julian Street.

He shows why in a startling and forceful article, in Collier's for June 19th, entitled "Our Next War". The lack of preparedness in the U. S. is clearly and convincingly stated.

If you are one of the many intelligent Americans who believe "Germany would tremble at the very thought of our taking part against her," read Street's amazing article and see why—"Alas, it is quite conceivable that Germany would laugh at the idea."

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THE NATIONAL WEEKLY
416 West 13th Street, New York City

Running Railroads by Water Power

(Concluded from page 603.)

ever, from Avery, Idaho, to the Pacific Coast. The railroad would like to electrify that portion of its line, but the power sites necessary to this accomplishment are controlled by the Government. Therefore, we have, on the same line of railroad, an electrified section in which no exhaustible coal supply is used and in which certain water powers that would otherwise be wasted are being utilized. This is the section which the conservation policy of the Government has not been able to affect. Along the other section, where the Government is all-powerful, the railroad is wasting enormous quantities of coal and the patrons of the road are being obliged to pay higher rates for transportation service than they otherwise would.

Of course, electrification by water power development is not possible over all railroads in the United States, but it is possible over the greater part of them. A supposedly righteous Government is regulating the railroads to the point of bankruptcy. A supposedly righteous people is demanding still lower rates and higher wages. Yet this supposedly righteous combination of Government and people has, by law, forbidden the railroads from accomplishing a very considerable part of the results which the combination demands.

Research and Industry

WITHIN the past few weeks two very instructive contributions have appeared on the importance of chemistry and chemical research to the industries to which chemistry may be applied. One of these contributions is a symposium of papers read before the New York section of the American Chemical Society and published in the industrial *Journal* of that society.

The second is a paper by Prof. P. F. Frankland before the Birmingham section of the Society of Chemical Industry. The American papers show great enthusiasm over advances made. The English papers show discouragement and almost despair on account of lack of co-operation between those who might benefit by it.

Hitherto such papers have been written by chemists or men actually engaged in research. In this instance the papers come from business men who have profited by research. Hence, they are to be regarded not as a pean of self-praise, but as dispassionate opinions on the business value of research. A number of the industries discussed are very old—so old that they go back to a time before chemistry became a science, being even then so well developed by experience that they were thoroughgoing industries. Under this head may be put the copper, cement and glass industries in the inorganic field, and the wine, sugar, textile, leather, brewing and paper industries in the organic field.

But, in spite of this, representatives of all these ancient industries gratefully acknowledge their indebtedness to the chemical research which has added to the knowledge and skill in working and definiteness of control, which has so much increased the profitableness of their industries and the satisfaction which they have in conducting them.

Other industries have been founded in comparatively recent years entirely as a result of chemical research. Among these the corn products, asphalt, cottonseed oil and celluloid industries, the fertilizer, soda and incandescent mantle industries are especially notable. Not only have these industries been founded on chemistry, but since their establishment persistent chemical research has improved the methods of manufacture and control, cheapening the product as well as maintaining a favorable balance for the manufacturer.

A large number of the industries contributing to the symposium are not what would strictly be called chemical industries. Their products are not chemical compounds, and while the processes used involve chemical changes, they are in

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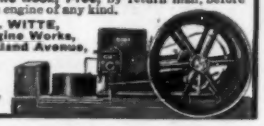

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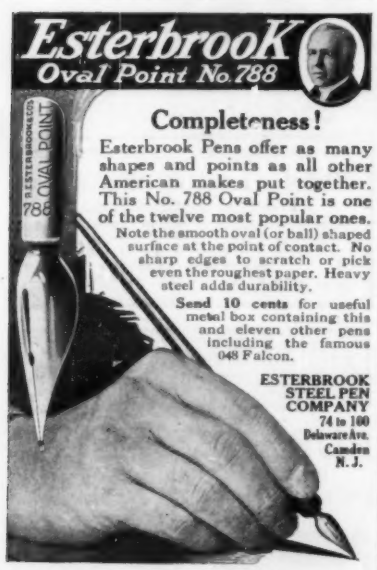

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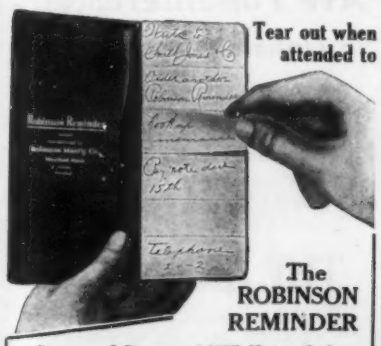

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many cases so confused and obscure that they would drive the systematic chemist to despair. That chemists have been able to be of aid even here is most encouraging, and that the executive officers of these industries should be willing to testify to the aid received is even more encouraging as evidence that a helpful cooperation is prevalent and is to be maintained. Part of the chemical work to which the industries are indebted is that which they have inherited from an older period or have borrowed from foreign research or foreign practice; but it is also true that a large part of this indebtedness is due to research by American chemists employed directly by the industries concerned.

Some of the results recorded are indeed almost miraculous. A very small quantity of arsenic in copper greatly lowers its conductivity; a quarter of 1 per cent cuts down its conductivity from 101 to 45. Refined copper for this purpose should contain less than one one-thousandth of 1 per cent of arsenic in order to satisfy the consumer. The chemists have made such results possible by their able research work and also by their remarkable improvements in analytical methods.

Glucose is the cheapest food-fuel known. Grape sugar or corn sugar also is an important product and is manufactured in a variety of grades. Due to the great care which the chemist exercises in devising ways and means of controlling the process of manufacture in all of its details, the quality of the articles produced is of such excellence as to have secured for this country by far the largest portion of the world's trade in these commodities.

While the chemist has worked to improve the manufacturing side of the cottonseed oil industry, he has been the means of putting something like $125,000,000 every year in the hands of farmers; or, in other words, he has added ten or twelve dollars to the crop for every bale of cotton grown and has made possible an industry which provides means of livelihood for thousands of people in hundreds of factories and on the road selling the products.

Beginning with a trifling manufacture forty years ago, the cement industry, after fighting against difficulties in manufacture and against peculiar marketing prejudices, now produces 125,000,000 barrels of cement per year. This advance is nearly all due to the work of chemists, who first proved that we have suitable material, and then that we can use these materials in making really superior cement, devising apparatus and working out methods of control, and especially showing users of cement how to get the best results in their work.

All through the development of the sugar industry the chemists' work has been of assistance in so many ways that they cannot even be summarized.

After solving the very fundamental principles of the manufacture of incandescent mantles, in the further development of industry "the mantle manufacturer has held before himself for many years certain ideals toward which he has earnestly striven. Among these may be mentioned strength with elasticity, high and maintained candle power, preservation of color, and absence of shrinkage. A realization of these ideals seems finally to have been met in the mantles made from the bundles of homogeneous, elastic, spring-like fiber known as artificial silk."

The textile industry is aided by the chemist all through, in bleaching, in dyeing, and in producing dyes. Artificial silk, now widely used, is an entirely chemical product.

As to the flour industry: "Chemistry assists in selecting and buying the grain; it helps to show the quality of the flour produced. It has supplemented mechanical processes of the mill and accomplished what had long been desired but could not be attained, in the improvement of color and baking qualities of the flour. By the introduction of baking powder products it has made possible many delicacies in the way of pastry and biscuit and has made possible the great self-rising flour industry. It has helped to

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JUNE 5, 1915

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In the June 5th number the Editors have done full justice to the great theme of American inventions, producing a number which will transport us all back to the time when our fathers and grandfathers still burned candles, when horses still pulled street cars, when there were no automobiles, and when the steam railroad was a curiosity.

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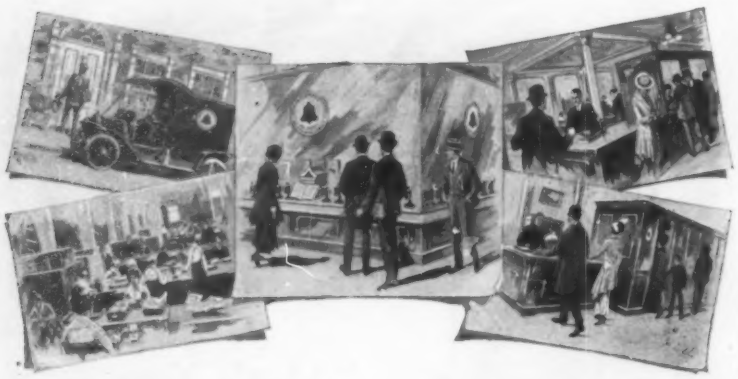

Doing Business with a Business Concern

The business man is an important factor in your daily life and happiness.

He may raise wheat or cattle; he may manufacture flour or shoes; he may run a grocery or a drygoods store; he may operate a copper mine or a telephone company. He creates or distributes some commodity to be used by other people.

He is always hard at work to supply the needs of others, and in return he has his own needs supplied.

All of us are doing business with business men so constantly that we accept the benefits of this intercourse without question, as we accept the air we breathe. Most of us have little to do with government, yet we recognize the difference between business methods and government methods.

We know that it is to the interest of the business man to do something for us, while the function of the government man is to see that we do something for ourselves—that is, to control and regulate.

We pay them both, but of the two we naturally find the business man more get-at-able, more human, more democratic.

Because the telephone business has become large and extensive, it requires a high type of organization and must employ the best business methods.

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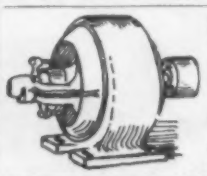

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explain the intricate process of the fermentation of bread dough, has pointed out the way to fit flour for it, and has unlocked doors for investigating problems of bread production, which have, as yet, opened only enough to permit a glimpse of a large space filled with interesting and useful possibilities."

The pyroxylin industry, which produces celluloid, collodion, guncotton, smokeless powder of certain kinds, artificial silk, and picture films is wholly due to chemistry, and as a result "there is not a factory of pyroxylin compounds of any importance in existence to-day that has not its busy staff of analytical, managing and research chemists."

Soon after the beginning of modern chemistry work was begun to improve the ancient industry of glassmaking. These studies have been made by German and French chemists in the main until rather recently when American investigators have also entered the field and made advances. The chemical researches made on glass have been especially systematic and have been directed to leaving the connection between the composition of glass and the various mechanical and physical peculiarities which fit each kind of glass for its intended use.

The great desirability of co-operation between manufacturers and chemists is very strongly expressed in the address of Prof. Frankland on the "Chemical Industries of Germany." After recounting at length and with high appreciation the story of cordial co-operation of manufacturers, chemists and the government in the development of those industries, he goes on to speak of the contracting condition in England in words which deserve to be quoted as a warning:

"The facts which I have brought forward speak for themselves and proclaim in the most convincing manner the stupendous progress which has been made by Germany in the chemical industries during the past forty years. It is equally certain that England, once pre-eminent for chemical manufacture, has not progressed at the same rate, and is at the present moment suffering much inconvenience through being so largely dependent on German chemical products of one kind and another. The country is now reaping the harvest of humiliation which it has sown for itself in spite of the warnings repeated *ad nauseam* by the chemical profession during a whole generation. The systematic neglect of chemical science and the failure by manufacturers to utilize the services of highly qualified chemists could only lead to the result that all the industries which are dependent on a profound knowledge of chemistry should tend to disappear from our midst and pass into the hands of those who are prepared, not only to apply new chemical discoveries to industry, but even to prosecute the most varied chemical investigations in the hope of sooner or later making discoveries which shall be of advantage to their commercial undertakings.

"The complete breakdown in our supply of fine chemicals, which is the direct outcome of the disregard of the constant warnings emitted by scores of British chemists, has led the government of the day to intervene and attempt to remedy the intolerable state of affairs which has arisen in connection with the supply of coal-tar colors.

"It will certainly be necessary that expert chemical knowledge should in the future be much more highly remunerated than it has been in the past, otherwise the supply of able and properly qualified men will not be forthcoming. The flow of men of high-grade intelligence into a profession is determined by the prizes which the profession has to offer, in the form of money and social position.

"If there is to be a large influx of high intelligence into the chemical profession, it will be necessary that there should be some very different prizes from the paltry bait which is offered at the present time, for the study of chemistry in this country now only draws those men who either have or think they have an overpowering zeal and passion for the science, to which they devote themselves against the advice of their friends, and in spite of the warnings of the professors of chemistry by whom they are initiated. Notwithstanding the absence of material inducements, I venture to say without fear of contradiction that there is more original investigation being prosecuted in this country by chemists than by any other body of British men of science, and this I attribute to the fact that such a large proportion of our number have either been at German universities or are the pupils of those who have been at these centers of research. Nor are any of us, I am sure, even during this unfortunate crisis, unmindful of the hospitality and the inspiration which we have received in the schools of the enemy. If the proposed undertaking is to succeed, real chemists must be on the directorate, and in a sufficient proportion to give effect to their views. Many men of science are excellent business men."

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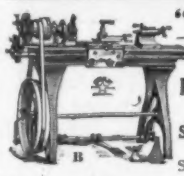

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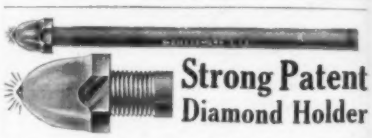

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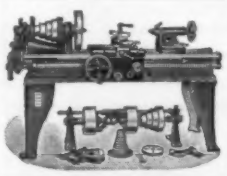

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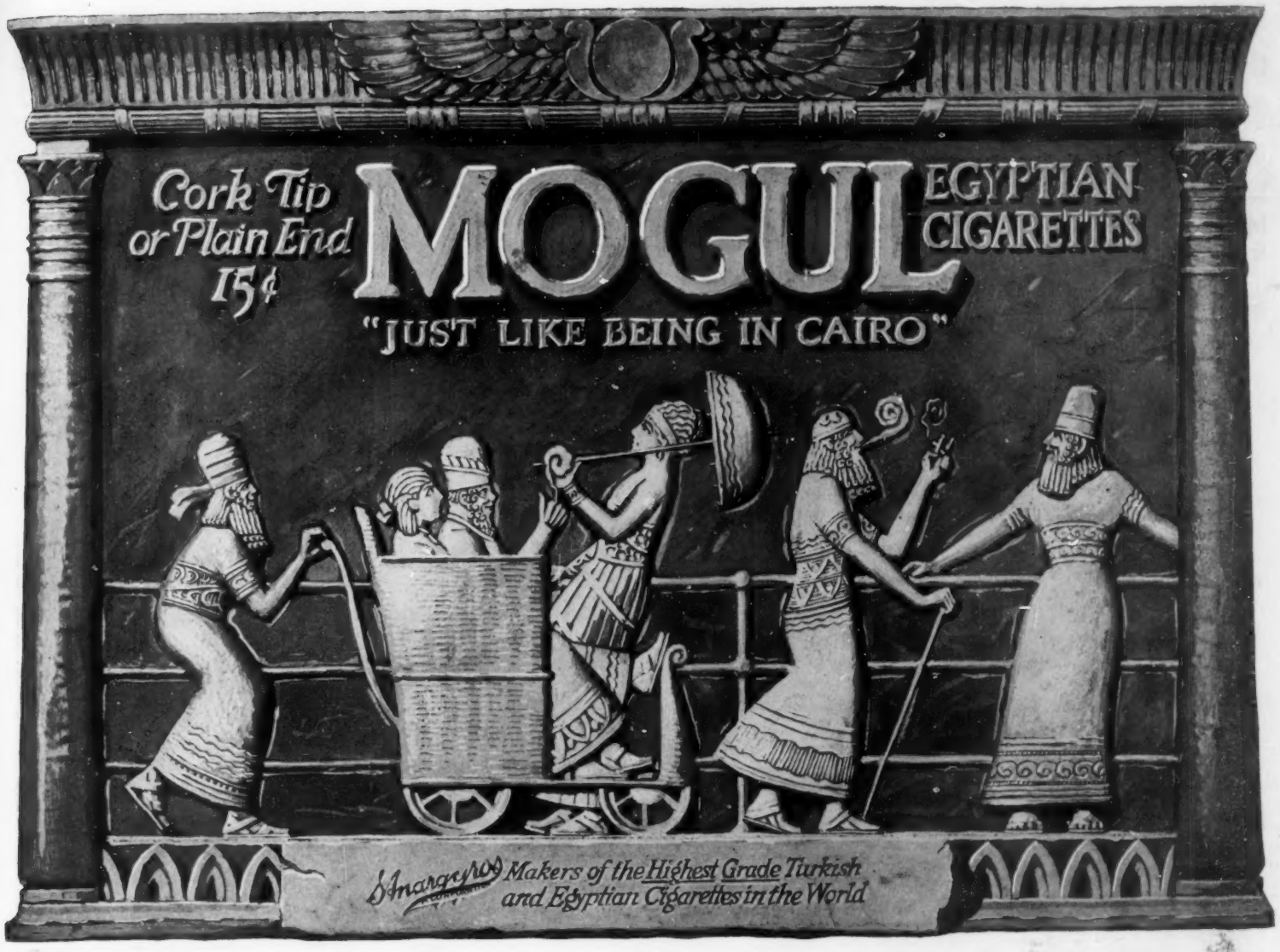

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